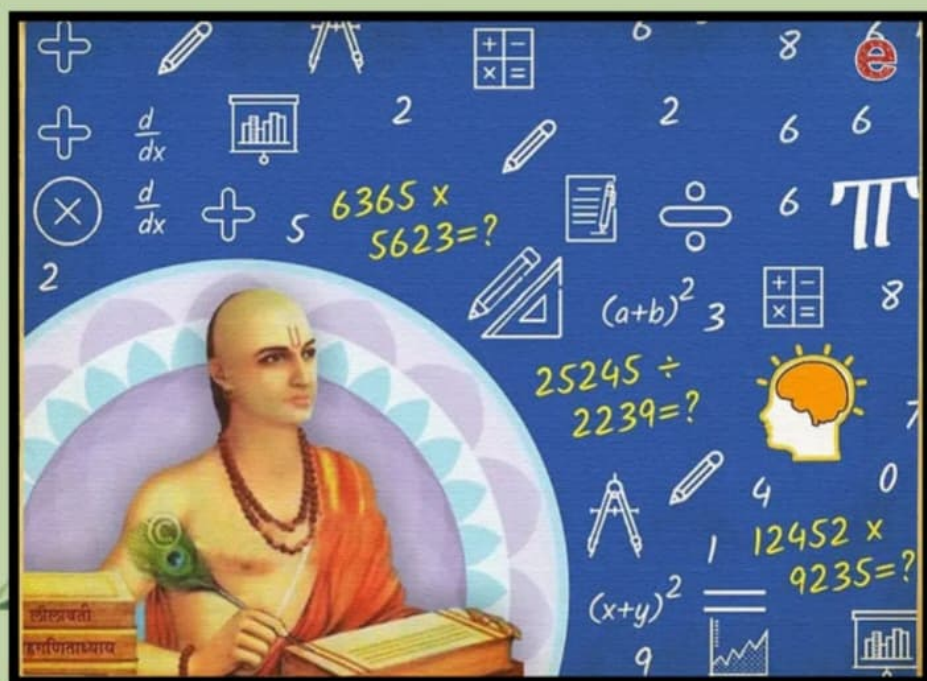


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A Study of Practical Applications of Vedic Mathematics



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- Prachi



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Preface

Today we can not imagine a single day in our lives without mathematics because even to solve the problems of daily life. We have to depend on mathematics in some form or the other. Mathematics helps us to contact the environment around us. Mathematics is an important tool in increasing the understanding of the world. It is like any natural source around us which we can easily experience. Any person, whether he is a laborer, farmer, businessman, doctor or lawyer, uses the numbers and principles of mathematics every day. Works like office, playground etc. Mathematics is present everywhere. Every person uses mathematics directly or indirectly to earn his livelihood. We can easily solve many problems of our daily life through mathematics. There are many benefits of learning Vedic Mathematics. It develops problem solving ability in the student and leads to the development of creative intelligence.

The title of this book is “**A STUDY OF PRACTICAL APPLICATIONS OF VEDIC MATHEMATICS.**” This study has been divided into five chapters.

In the first chapter, the nature of upper primary education in India, place of mathematics in the curriculum, importance of mathematics teaching, methods of mathematics teaching, history of mathematics, problems of mathematics teaching, objectives of study of Vedic mathematics, research method and importance and significance of study have been described.

In the second chapter, research studies related to mathematics proficiency and research studies related to Vedic mathematics have been reviewed.

In the third chapter, selected Vedic mathematics operations H.C.F, L.C.M, simple equations, factors of seed expression and the entire surface area of the cuboid have been explained in detail.





In the fourth chapter, a suggested format has been presented for the inclusion of various Vedic mathematics operations in classes four, five, seven and eight.

In the fifth chapter, Conclusion suggestions for educational utility study and suggestions for future research have been presented.

Certainly the book will be useful for all college students and teachers specially for research scholars.

It is natural that there may be many errors in the present book. Therefore, if experienced scholars will take the trouble to inform, then we will be very grateful.

DATE – 10/03/2026

Dr. Rajeev Agrawal
Surendra Kumar
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Chapter -1

INTRODUCTION OF THE STUDY

- 1.1 Educational Development**
- 1.2 Development of Mathematics**
- 1.3 Development of Vedic Mathematics**
- 1.4 Need to Study**
- 1.5 Statements of the Problem**
- 1.6 Definition of terms used in the Study**
- 1.7 Objective of the Study**
- 1.8 Delimitations of the Study**
- 1.9 Research Method**
- 1.10 Importance and Significance of the Study**



First Chapter

Introduction of the Study

1.1 Educational Development

Educational development is a growing and vibrant field, defined as:

- “helping colleges and universities function effectively as teaching and learning communities” (Felted, Kalish, Pingree, & Plank, 2007.)
- actions “aimed at enhancing teaching” (Amundsen & Wilson, 2012,)
- a “key lever for ensuring institutional quality and supporting institutional change” (Sorcinelli, Austin, Eddy & Beach, 2005).

What all of these definitions have in common is the enhancement of the work of colleges and universities, often with a focus on teaching and learning. The POD (The POD Network is North America’s largest educational development community) Network prefers the term “educational development” (instead of, for example, “faculty development”) because, according to Past President Deandra Little (2014), it better “encompasses the breadth of work we do,” including levels (individual, program, and institutional) and key audiences (graduate students, faculty, postdoctoral scholars, administrators, organizations) served. Educational development is possible with the study of all subjects including mathematics.

Educational development is possible with the study of all subjects including mathematics

1.1.1 Stages of Education of India

Education in India follows a uniform structure of school education which is known as the 10+2 system. This system is being followed by all Indian States and Union Territories. But not all of them follow a distinct pattern as per the system.

- 1. Pre Primary Stage** – Pre primary education in India is provided to children between 3–6 years by Kindergarten, Play way or Play Schools. These schools have varying terminology for different levels of classes, beginning from – Pre-Nursery, Nursery, KG, LKG (Lower Kindergarten) and UKG (Upper Kindergarten). Most of the pre-primary education in India is provided by private schools.
- 2. The Primary Stage** – Primary education in India offered by both private and government schools usually consist of students aged between 5 to 12 years. The duration of study in this stage is 4-5 years. Common subjects include English, Hindi, Mathematics, Environmental Science and General Knowledge. Sometimes also termed as Elementary Education, it is free in government schools but it is paid in the private schools. The Government has made elementary education compulsory for children between the age group of years 6 and 14. Most of the primary education provided by primary schools in India is imparted from class 1st to class 4th or 5th. Some of the states/UTs which follow 1st to 5th class of primary education are Andhra Pradesh, Arunachal Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Manipur, Orissa, Punjab, Chandigarh, Delhi, Karaikal and Yanam regions of Pondicherry etc.

Some of the states/UTs which follow 1st to 4th classes of primary education are Assam, Goa, Gujarat, Karnataka, Kerala, Maharashtra, Meghalaya, Mizoram, Nagaland, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep and Mahe region of Pondicherry.

3. **The Middle Stage** – Middle stage of education covering 3-4 years of academic study is formed by 5th-8th class consisting of students aged between 12 to 14 years. The schools which impart education up till 8th class are known with various names like – High School, Senior School. Some of the states/UTs which follow 5th -7th class of middle stage are Assam, Goa, Gujarat, Karnataka, Kerala, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep etc. Some of the states/UTs which follow 6th -8th class of middle stage are Arunachal Pradesh, Haryana, Madhya Pradesh, Punjab, Andaman & Nicobar Islands, Chandigarh, Delhi etc.
4. **The Secondary Stage** – Secondary Stage of education covering 2-3 years of academic study starts with classes 8th-10th. Consisting of students aged between 14-16 years. The schools which impart education up till 10th class are known as Secondary Schools, High Schools, Senior Schools etc. Some of the states/UTs which follow 8th -10th class of secondary stage are Goa, Gujarat, Karnataka, Kerala, Dadra & Nagar Haveli, Daman & Diu, Lakshadweep etc. Some of the states/UTs which follow 9th -10th class of secondary stage are Punjab, Rajasthan, Sikkim, Tamil Nadu, Andaman & Nicobar Islands, Chandigarh, Delhi, Karaikal region of Pondicherry etc.
5. **Senior Secondary Stage** – Senior Secondary Education in India is of only 2 years. There is uniformity on this level of education in terms of duration and classes i.e. all the States/UTs follow this 10+2 pattern. Senior Secondary Schools in India include classes 11th to 12th. Consisting students aged between 16-18 years. At this level of education students have the freedom to choose their preferred stream and subjects. They can pursue Arts, Commerce, Science (medical & non medical). The schools which provide education up till 12th class are commonly known as Senior Secondary Schools or Higher Secondary Schools. Some universities and colleges also offer the education of these classes.
6. **Undergraduate Stage** – Undergraduate education in India is of 3-4 years. Undergraduate stage of education is also known as higher education in India. Students studying in this level, generally begin their education from 18 onwards. As per one estimate 88% of undergraduate education is provided by Colleges in India. Majority of the undergraduate courses of 3 years duration belong to field of arts, humanities, science etc. and majority of 4 years of duration belong to the field of agriculture, engineering, pharmaceutical sciences technology. However, there are courses belonging to fields of architecture, law and medicine whose duration is 5 years.
7. **Postgraduate Stage** – Postgraduate education in India is of 2-3 years. Postgraduate stages of courses are known as Masters courses or Doctorate courses. Masters course are usually of 2 years duration and doctorate (research) courses are of 3 years duration. Also referred as higher education, 56% of post-graduate education is imparted through colleges. PG education in India is largely provided by universities in India. PG education caters largely to a specific field or sub field of any preferred discipline. Thus, one can

specialise in any of preferred subjects at this level. Those who are interested in conducting large amount of research work pursue these courses.

1.2 Development of Mathematics

1.2.1 Meaning and Definition of Mathematics

Mathematics is the science and study of quality, structure, space, and change. Mathematicians seek out patterns, formulate new conjectures, and establish truth by rigorous deduction from appropriately chosen axioms and definitions.

Definition of Mathematics

Mathematics simply means to learn or to study or gain knowledge. The theories and concepts given in Mathematics help us understand and solve various types of problems in academic as well as in real life situations.

“Mathematics is the music of reason.” **(Paul Lockhart)**

“Mathematics is the poetry of the universe.” **(Jonathan David Farley)**

“Mathematics is the queen of the sciences.” **(Carl Friedrich Gauss)**

“Mathematics is the discipline dealing with nontrivial and interesting things.” **(Jody Azzouni)**

“All that is correct thinking is mathematics.” **(Grigore Moisil)**

“Mathematics is the door and key of the sciences.” **(Roger Bacon)**

“Mathematics is the science of what is clear by itself.” **(Carl Jacobi)**

“Mathematics is as much an aspect of culture as it is a collection of algorithms.” **(Carl Boyer)**

“Mathematics is the art of giving the same name to different things.” **(Henri Poincaré)**

“Mathematics is the supreme judge; from its decisions there is no appeal.” **(Tobias Dantzig)**

“Pure mathematics is, in its way, the poetry of logical ideas.” **(Albert Einstein)**

“As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.” **(Albert Einstein)**

“The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as in poetry.” **(Bertrand Russell)**

“Mathematics is, I believe, the chief source of the belief in eternal and exact truth, as well as a sensible intelligible world.” **(Bertrand Russell)**

1.2.2 Aims of Teaching and Learning Mathematics

- The aims of teaching and learning mathematics are to encourage and enable students to:
- That mathematics permeates the world around us
- Appreciate the usefulness, power and beauty of mathematics
- Enjoy mathematics and develop patience and persistence when solving problems
- Understand and be able to use the language, symbols and notation of mathematics
- Develop mathematical curiosity and use inductive and deductive reasoning when solving problems
- Become confident in using mathematics to analyse and solve problems both in school and in real-life situations
- Develop the knowledge, skills and attitudes necessary to pursue further studies in mathematics
- Develop abstract, logical and critical thinking and the ability to reflect critically upon their work and the work of others
- Develop a critical appreciation of the use of information and communication technology in mathematics
- Appreciate the international dimension of mathematics and its multicultural and historical perspectives.

1.2.3 Objectives of Mathematics

A - Knowledge and Understanding

Knowledge and understanding are fundamental to studying mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.

At the end of the course, students should be able to:

- Know and demonstrate understanding of the concepts from the five branches of mathematics (number, algebra, geometry and trigonometry, statistics and probability, and discrete mathematics)
- Use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts
- Select and apply general rules correctly to solve problems including those in real-life contexts.

B - Investigating Patterns

Investigating patterns allows students to experience the excitement and satisfaction of mathematical discovery. Mathematical inquiry encourages students to become risk-takers, inquirers and critical thinkers. The ability to inquire is invaluable in the MYP and contributes to lifelong learning.

At the end of the course, when investigating problems, in both theoretical and real-life contexts, student should be able to:

- Select and apply appropriate inquiry and mathematical problem-solving techniques

- Recognize patterns
- Describe patterns as relationships or general rules
- Draw conclusions consistent with findings
- Justify or prove mathematical relationships and general rules.

C - Communication in Mathematics

Mathematics provides a powerful and universal language. Students are expected to use mathematical language appropriately when communicating mathematical ideas, reasoning and findings—both orally and in writing.

At the end of the course, students should be able to communicate mathematical ideas, reasoning and findings by being able to:

- Use appropriate mathematical language (notation, symbols, terminology) in both oral and written explanations
- Use different forms of mathematical representation (formulae, diagrams, tables, charts, graphs and models)
- Move between different forms of representation

D - Reflection in Mathematics

MYP mathematics encourages students to reflect upon their findings and problem-solving processes. Students are encouraged to share their thinking with teachers and peers and to examine different problem-solving strategies. Critical reflection in mathematics helps students gain insight into their strengths and weaknesses as learners and to appreciate the value of errors as powerful motivators to enhance learning and understanding.

At the end of the course students should be able to:

- Explain whether their results make sense in the context of the problem
- Explain the importance of their findings
- Justify the degree of accuracy of their results where appropriate
- Suggest improvements to the method when necessary

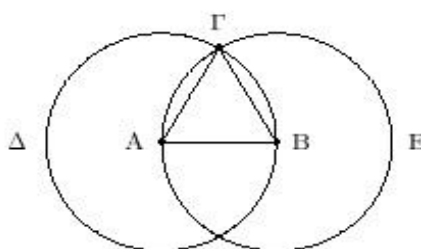
1.2.4 History of Mathematics

The history of mathematics deals with the origin of discoveries in mathematics and the mathematical methods and notation of the past. Before the modern age and the worldwide spread of knowledge, written examples of new mathematical developments have come to light only in a few locales. From 3000 BC the Mesopotamian states of Sumer, Akkad and Assyria, followed closely by Ancient Egypt and the Levantine state of Ebla began using arithmetic, algebra and geometry for purposes of taxation, commerce, trade and also in the patterns in nature, the field of astronomy and to record time and formulate calendars.

The earliest mathematical texts available are from Mesopotamia and Egypt – Plimpton 322 (Babylonian 2000 – 1900 BC), the Rhind Mathematical Papyrus (Egyptian 1800 BC) and the Moscow Mathematical Papyrus (Egyptian 1890 BC). All of these texts mention the so-called Pythagorean triples, so, by inference, the Pythagorean theorem seems to be the most ancient and widespread mathematical development after basic arithmetic and geometry.

Many Greek and Arabic texts on mathematics were translated into Latin from the 12th century onward, leading to further development of mathematics in Medieval Europe. From ancient times through the Middle Ages, periods of mathematical discovery were often followed by centuries of stagnation.[citation needed] Beginning in Renaissance Italy in the 15th century, new mathematical developments, interacting with new scientific discoveries, were made at an increasing pace that continues through the present day. This includes the groundbreaking work of both Isaac Newton and Gottfried Wilhelm Leibniz in the development of infinitesimal calculus during the course of the 17th century

Ἐπὶ τῆς δοθείσης εὐθείας πεπερασμένης τριγώνων ἰσόπλευρον συστήσασθαι.
 Ἐστω ἡ δοθείσα εὐθεῖα πεπερασμένη ἡ AB.
 Δεῖ δὴ ἐπὶ τῆς AB εὐθείας τριγώνων ἰσόπλευρον συστήσασθαι.



Κέντρον μὲν τῷ A διαστήματι δὲ τῷ AB κύκλος γεγράφθω ὁ ΒΓΔ, καὶ πάλιν κέντρον μὲν τῷ B διαστήματι δὲ τῷ ΒΑ κύκλος γεγράφθω ὁ ΑΓΕ, καὶ ἀπὸ τοῦ Γ σημείου, καθ' ὃ τέμνουσιν ἀλλήλους αἱ κύκλοι, ἐπὶ τὰ Α, Β σημεία ἐπεζεύχθωσαν εὐθεῖαι αἱ ΓΑ, ΓΒ.

Καὶ ἐπεὶ τὸ Α σημεῖον κέντρον ἐστὶ τοῦ ΓΔΒ κύκλου, ἴση ἐστὶν ἡ ΑΓ τῇ ΒΓ· πάλιν, ἐπεὶ τὸ Β σημεῖον κέντρον ἐστὶ τοῦ ΓΑΕ κύκλου, ἴση ἐστὶν ἡ ΒΓ τῇ ΒΑ. ἔδειχθη δὲ καὶ ἡ ΓΑ τῇ ΑΒ ἴση· ἑκατέρα ἄρα τῶν ΓΑ, ΓΒ τῇ ΑΒ ἐστὶν ἴση· τὰ δὲ τῷ αὐτῷ ἴσα καὶ ἀλλήλοις ἐστὶν ἴσα· καὶ ἡ ΓΑ ἄρα τῇ ΓΒ ἐστὶν ἴση· αἱ τρεῖς ἄρα αἱ ΓΑ, ΑΒ, ΒΓ ἴσαι ἀλλήλαις εἰσὶν.

Ἰσόπλευρον ἄρα ἐστὶ τὸ ΑΒΓ τρίγωνον, καὶ συνέσταται ἐπὶ τῆς δοθείσης εὐθείας πεπερασμένης τῆς ΑΒ.

[Ἐπὶ τῆς δοθείσης ἄρα εὐθείας πεπερασμένης τριγώνων ἰσόπλευρον συνέσταται]:
 ὅπερ ἔδει ποιῆσαι.

The earliest mathematical texts available are from Mesopotamia and Egypt – Plimpton 322 (Babylonian 2000 – 1900 BC), the Rhind Mathematical Papyrus (Egyptian 1800 BC) and the Moscow Mathematical Papyrus (Egyptian 1890 BC). All of these texts mention the so-called Pythagorean triples, so, by inference, the Pythagorean theorem seems to be the most ancient and widespread mathematical development after basic arithmetic and geometry. many Greek and Arabic texts on mathematics were translated into Latin from the 12th century onward, leading to further development of mathematics in Medieval Europe. from ancient times through the Middle Ages, periods of mathematical discovery were often followed by centuries of stagnation. Beginning in Renaissance Italy in the 15th century, new mathematical developments, interacting with new scientific discoveries, were made at an increasing

pace that continues through the present day. This includes the groundbreaking work of both Isaac Newton and Gottfried Wilhelm Leibniz in the development of infinitesimal calculus during the course of the 17th century.

1.2.4.1 Prehistoric

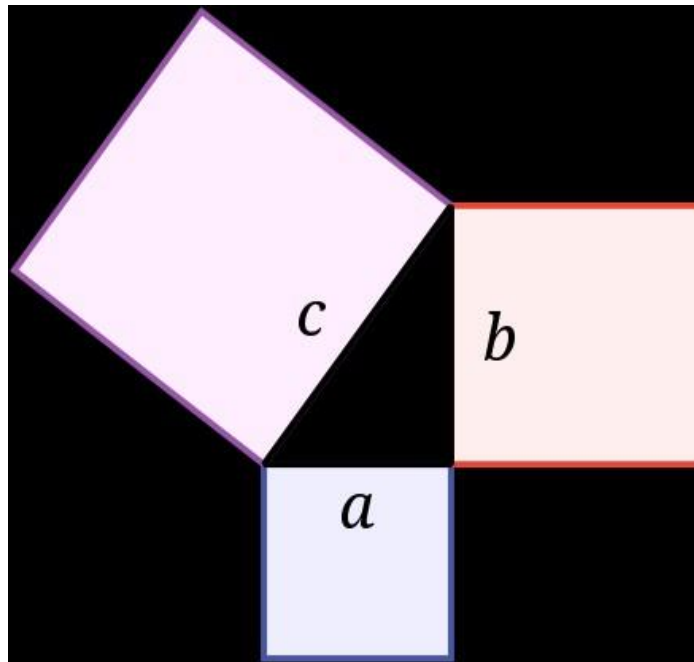
The origins of mathematical thought lie in the concepts of number, patterns in nature, magnitude, and form. Modern studies of animal cognition have shown that these concepts are not unique to humans. Such concepts would have been part of everyday life in hunter-gatherer societies. The idea of the “number” concept evolving gradually over time is supported by the existence of languages which preserve the distinction between “one”, “two”, and “many”, but not of numbers larger than the Ishango bone, found near the headwaters of the Nile river (northeastern Congo), may be more than 20,000 years old and consists of a series of marks carved in three columns running the



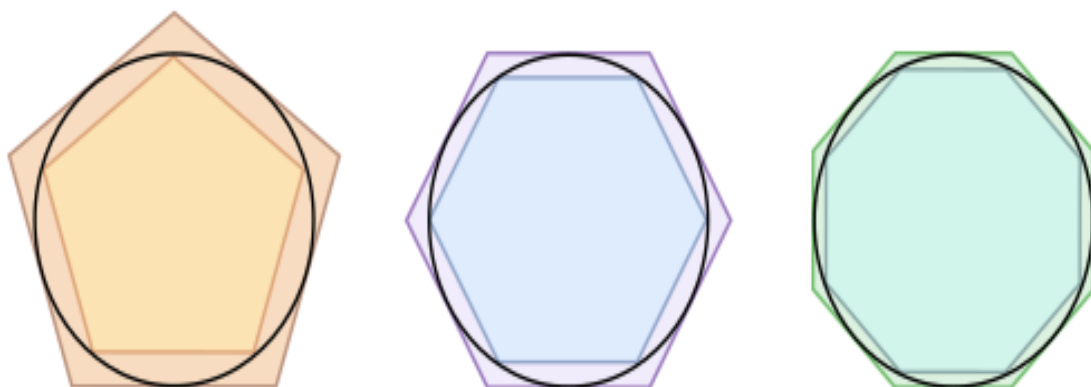
length of the bone. Common interpretations are that the Ishango bone shows either a tally of the earliest known demonstration of sequences of prime numbers or a six-month lunar calendar. Peter Rudman argues that the development of the concept of prime numbers could only have come about after the concept of division, which he dates to after 10,000 BC, with prime numbers probably not being understood until about 500 BC. He also writes that “no attempt has been made to explain why a tally of something should exhibit multiples of two, prime numbers between 10 and 20, and some numbers that are almost multiples of 10.” The Ishango bone, according to scholar Alexander Marshack, may have influenced the later development of mathematics in Egypt as, like some entries on the Ishango bone, Egyptian arithmetic also made use of multiplication by 2; this however, is disputed.

1.2.4.2 Greek

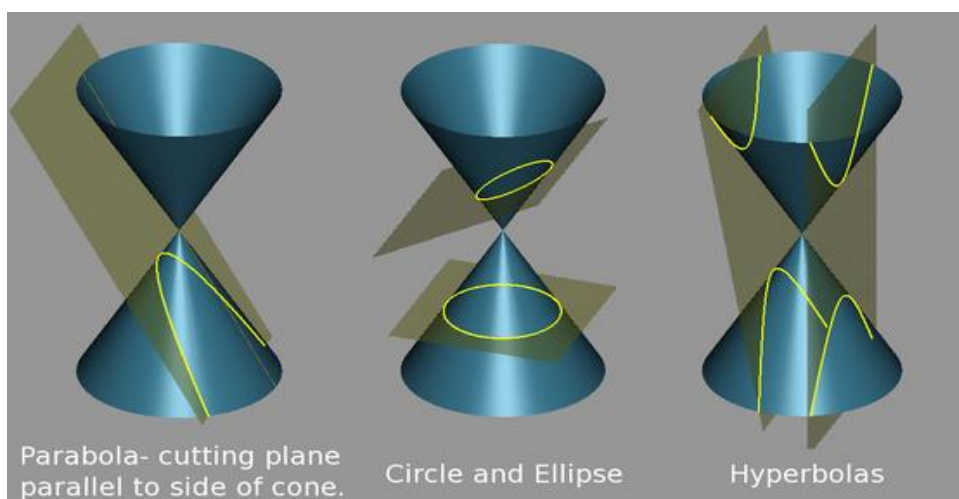
The Pythagorean theorem. The Pythagoreans are generally credited with the first proof of the theorem. Greek mathematics refers to the mathematics written in the Greek language from the time of Thales of Miletus (~600 BC) to the closure of the Academy of Athens in 529 AD. Greek mathematicians lived in cities spread over the entire Eastern Mediterranean, from Italy to North Africa, but were united by culture and language. Greek mathematics of the period following Alexander the Great is sometimes called Hellenistic mathematics.



Greek mathematics was much more sophisticated than the mathematics that had been developed by earlier cultures. All surviving records of pre-Greek mathematics show the use of inductive reasoning, that is, repeated observations used to establish rules of thumb. Greek mathematicians, by contrast, used deductive reasoning. The Greeks used logic to derive conclusions from definitions and axioms, and used mathematical rigor to prove them. Thales used geometry to solve problems such as calculating the height of pyramids and the distance of ships from the shore. He is credited with the first use of deductive reasoning applied to geometry, by deriving four corollaries to Thales' Theorem. As a result, he has been hailed as the first true mathematician and the first known individual to whom a mathematical discovery has been attributed. Pythagoras established the Pythagorean School, whose doctrine it was that mathematics ruled the universe and whose motto was "All is number". It was the Pythagoreans who coined the term "mathematics", and with whom the study of mathematics for its own sake begins.



Archimedes (287–212 BC) of Syracuse, widely considered the greatest mathematician of antiquity, used the method of exhaustion to calculate the area under the arc of a parabola with the summation of an infinite series, in a manner not too dissimilar from modern calculus. He also showed one could use the method of exhaustion to calculate the value of π with as much precision as desired, and obtained the most accurate value of π then known, $(3+10/71) < \pi < (3+10/70)$. He also studied the spiral bearing his name, obtained formulas for the volumes of surfaces of revolution (paraboloid, ellipsoid, hyperboloid), and an ingenious method of exponentiation for expressing very large numbers. While he is also known for his contributions to physics and several advanced mechanical devices, Archimedes himself placed far greater value on the products of his thought and general mathematical principles. He regarded as his greatest achievement his finding of the surface area and volume of a sphere, which he obtained by proving these are $2/3$ the surface area and volume of a cylinder circumscribing the sphere.



Apollonius of Perga made significant advances in the study of conic sections.

Apollonius of Perga (262–190 BC) made significant advances to the study of conic sections, showing that one can obtain all three varieties of conic section by varying the angle of the plane that cuts a double-napped cone. He also coined the terminology in use today for conic sections, namely parabola (“place beside” or “comparison”), “ellipse” (“deficiency”), and “hyperbola” (“a throw beyond”). While neither Apollonius nor any other Greek mathematicians made the leap to coordinate geometry, Apollonius’ treatment of curves is in some ways similar to the modern treatment, and some of his work seems to anticipate the development of analytical geometry by Descartes some 1800 years later.

1.2.4.3 Indian

Earliest civilization on the Indian subcontinent is the Indus Valley civilization (mature phase: 2600 to 1900 BC) that flourished in the Indus river basin. Their cities were laid out with geometric regularity, but no known mathematical documents survive from this civilization.

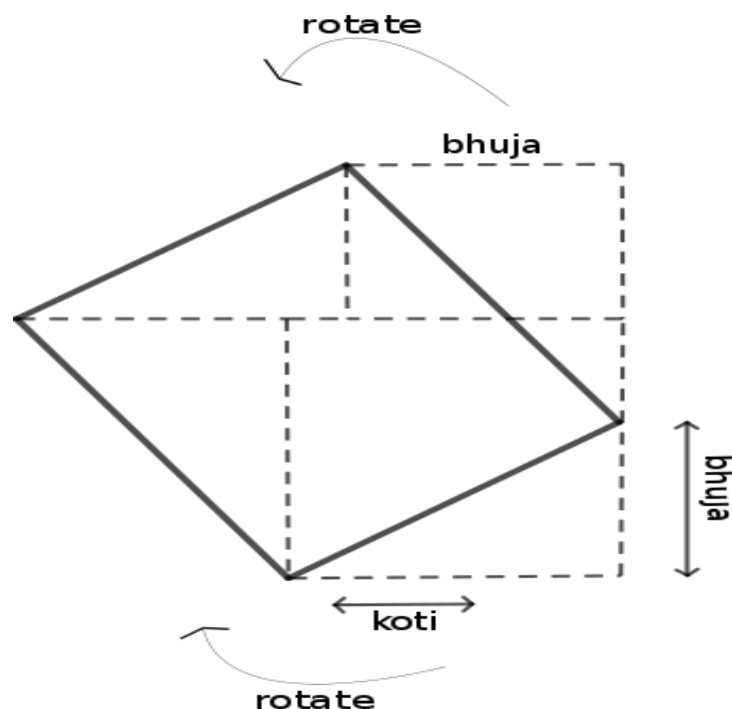
The oldest extant mathematical records from India are the Sulba Sutras (dated variously between the 8th century BC and the 2nd century AD), appendices to religious texts which give simple rules for constructing altars of various shapes, such as squares, rectangles, parallelograms, and others. As with Egypt, the preoccupation with temple functions points to an origin of mathematics in religious ritual. The Sulba Sutras give methods for constructing a

TABLE SHOWING THE PROGRESS OF NUMBER FORMS IN INDIA																						
NUMERALS	1	2	3	4	5	6	7	8	9	10	20	30	40	50	60	70	80	90	100	200	1000	
^a Aśoka	I	II	III	IIII																		c. 250 BCE
^b Śaka	I	II	III	×	IX	II	X	XX	?	3				733333				AI	711			c. 50 BCE
^c Aśoka	I	II	+	6										6				A				c. 250 BCE
^d Nāgarī (Naneghat)	-	=	♀	47	2	α	0							+	0			HH	T			c. 75 BCE
^e Nasik	-	=	≡	+	h	φ	?	?	?	α	0	X						777				c. 100 CE
^f Kṣatrapa	-	=	≡	+	h	φ	?	?	?	α	0	X	?	?	?	?	?	?	?	?	?	c. 200 CE
^g Kuṣāna	-	=	≡	+	h	φ	?	?	?	α	0	X	?	?	?	?	?	?	?	?	?	c. 150 CE
^h Gupta	-	=	≡	+	h	φ	?	?	?	α	0	X	?	?	?	?	?	?	?	?	?	c. 350 CE

circle with approximately the same area as a given square, which imply several different approximations of the value of π . In addition, they compute the square root of 2 to several decimal places, list Pythagorean triples, and give a statement of the Pythagorean theorem. All of these results are present in Babylonian mathematics, indicating Mesopotamian influence. China It is not known to what extent the Sulba Sutras influenced later Indian mathematicians. As in China, there is a lack of continuity in Indian mathematics; significant advances are separated by long periods of inactivity. Pāṇini (5th century BC) formulated the rules for Sanskrit grammar. His notation was similar to modern mathematical notation, and used metarules, transformations, and recursion. Pingala (roughly 3rd–1st centuries BC) in his treatise of prosody uses a device corresponding to a binary numeral system. His discussion of the combinatorics of meters corresponds to an elementary version of the binomial theorem. Pingala's work also contains the basic ideas of Fibonacci numbers (called mātrāmeru).

1	2	3	4	5	6	7	8	9
-	=	≡	+	h	φ	?	?	?

The next significant mathematical documents from India after the Sulba Sutras are the Siddhantas, astronomical treatises from the 4th and 5th centuries AD (Gupta period) showing strong Hellenistic influence. They are significant in that they contain the first instance of trigonometric relations based on the half-chord, as is the case in modern trigonometry, rather than the full chord, as was the case in Ptolemaic trigonometry. Through a series of translation errors, the words “sine” and “cosine” derive from the Sanskrit “jiya” and “kojiya”



In the 12th century, Bhāskara II lived in southern India and wrote extensively on all then known branches of mathematics. His work contains mathematical objects equivalent or approximately equivalent to infinitesimals, derivatives, the mean value theorem and the derivative of the sine function. To what extent he anticipated the invention of calculus is a controversial subject among historians of mathematics.

In the 14th century, Madhava of Sangamagrama, the founder of the Kerala School of Mathematics, found the Madhava–Leibniz series and obtained from it a transformed series, whose first 21 terms he used to compute the value of π as 3.14159265359. Madhava also found the Madhava-Gregory series to determine the arctangent, the Madhava-Newton power series to determine sine and cosine and the Taylor approximation for sine and cosine functions. In the 16th century, Jyesthadeva consolidated many of the Kerala School’s developments and theorems in the *Yukti-bhāṣā*. It has been argued that the advances of the Kerala school, which laid the foundations of the calculus, were transmitted to Europe in the 16th century [144] via Jesuit missionaries and traders who were active around the ancient port of Muziris at the time and, as a result, directly influenced later European developments in analysis and calculus. [145] However, other scholars argue that the Kerala School did not formulate a systematic theory of differentiation and integration, and that there is not any direct evidence of their results being transmitted outside Kerala.

1.2.4.4 Mediaeval European

Medieval European interest in mathematics was driven by concerns quite different from those of modern mathematicians. One driving element was the belief that mathematics provided the key to understanding the created order of nature, frequently justified by Plato’s *Timaeus* and the biblical passage (in the Book of Wisdom) that God

had ordered all things in measure, and number, and weight. In the 12th century, European scholars traveled to Spain and Sicily seeking scientific Arabic texts, including al-Khwārizmī's *The Compendious Book on Calculation by Completion and Balancing*, translated into Latin by Robert of Chester, and the complete text of Euclid's *Elements*, translated in various versions by Adelard of Bath, Herman of Carinthia, and Gerard of Cremona. These and other new sources sparked a renewal of mathematics

One of the 14th-century Oxford Calculators, William Heytesbury, lacking differential calculus and the concept of limits, proposed to measure instantaneous speed "by the path that would be described by [a body] if... it were moved uniformly at the same degree of speed with which it is moved in that given instant" Heytesbury and others mathematically determined the distance covered by a body undergoing uniformly accelerated motion (today solved by integration), stating that "a moving body uniformly acquiring or losing that increment [of speed] will traverse in some given time a [distance] completely equal to that which it would traverse if it were moving continuously through the same time with the mean degree of speed".



Nicole Oresme at the University of Paris and the Italian Giovanni di Casali independently provided graphical demonstrations of this relationship, asserting that the area under the line depicting the constant acceleration, represented the total distance traveled. In a later mathematical commentary on Euclid's *Elements*, Oresme made a more detailed general analysis in which he demonstrated that a body will acquire in each successive increment of time an increment of any quality that increases as the odd numbers. Since Euclid had demonstrated the sum of the odd numbers are the square numbers, the total quality acquired by the body increases as the square of the time.

1.2.4.5 Mathematics during the scientific revolution

17th century - The 17th century saw an unprecedented increase of mathematical and scientific ideas across Europe. Galileo observed the moons of Jupiter in orbit about that planet, using a telescope based on a toy imported from Holland. Tycho Brahe had gathered an enormous quantity of mathematical data describing the positions of the planets in the sky. By his position as Brahe's assistant, Johannes Kepler was first exposed to and seriously interacted with the topic of planetary motion. Kepler's calculations were made simpler by the contemporaneous invention of logarithms by John Napier and Jost Bürgi. Kepler succeeded in formulating mathematical laws of planetary motion. The analytic geometry developed by René Descartes (1596–1650) allowed those orbits to be plotted on a graph, in Cartesian coordinates. building on earlier work by many predecessors, Isaac Newton discovered the laws of physics explaining Kepler's Laws, and brought together the concepts now known as calculus. Independently, Gottfried Wilhelm Leibniz, developed calculus and much of the calculus notation still in use today. He also refined the binary number system, which is the foundation of nearly all digital (electronic, solid-state, discrete logic) computers, including the Von Neumann architecture, which is the standard design paradigm, or "computer architecture", followed from the second half of the 20th century, and into the 21st. Leibniz has been called the "founder of computer science"



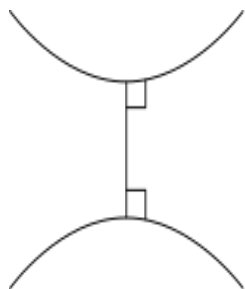
In addition to the application of mathematics to the studies of the heavens, applied mathematics began to expand into new areas, with the correspondence of Pierre de Fermat and Blaise Pascal. Pascal and Fermat set the groundwork for the investigations of probability theory and the corresponding rules of combinatorics in their discussions over a game of gambling. Pascal, with his wager, attempted to use the newly developing probability theory to argue for a life devoted to religion, on the grounds that even if the probability of success was small, the rewards were infinite. In some sense, this foreshadowed the development of utility theory in the 18th–19th century.

18th century -

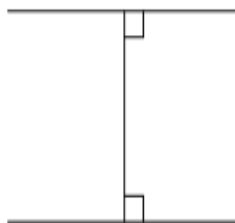


The most influential mathematician of the 18th century was arguably Leonhard Euler (1707–1783). His contributions range from founding the study of graph theory with the Seven Bridges of Königsberg problem to standardizing many modern mathematical terms and notations. For example, he named the square root of minus 1 with the symbol i , and he popularized the use of the Greek letter π to stand for the ratio of a circle's circumference to its diameter. He made numerous contributions to the study of topology, graph theory, calculus, combinatorics, and complex analysis, as evidenced by the multitude of theorems and notations named for him. Other important European mathematicians of the 18th century included Joseph Louis Lagrange, who did pioneering work in number theory, algebra, differential calculus, and the calculus of variations, and Laplace who, in the age of Napoleon, did important work on the foundations of celestial mechanics and on statistics.

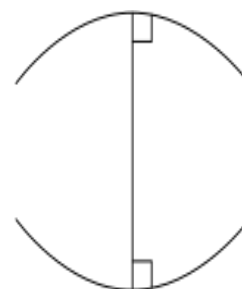
Modern - Throughout the 19th century mathematics became increasingly abstract. Carl Friedrich Gauss (1777–1855) epitomizes this trend. He did revolutionary work on functions of complex variables, in geometry, and on the convergence of series, leaving aside his many contributions to science. He also gave the first satisfactory proofs of



Hyperbolic



Euclidean



Elliptic

the fundamental theorem of algebra and of the quadratic reciprocity law behavior of lines with a common perpendicular in each of the three types of geometry

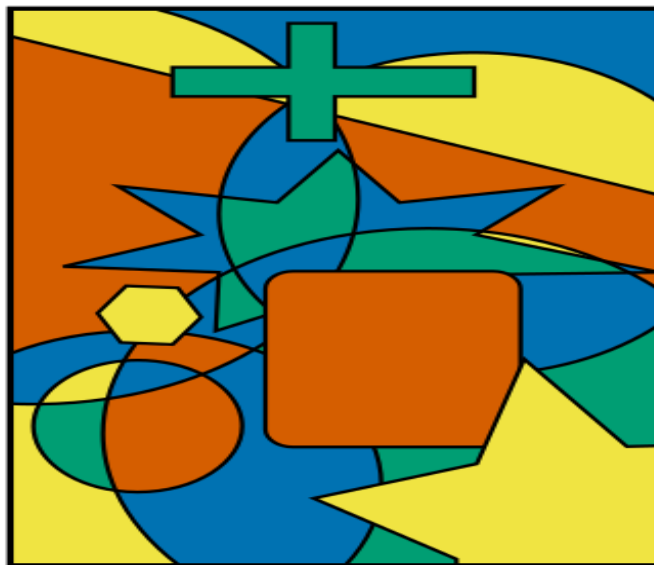
The 19th century saw the beginning of a great deal of abstract algebra. Hermann Grassmann in Germany gave a first version of vector spaces, William Rowan Hamilton in Ireland developed noncommutative algebra. The British mathematician George Boole devised an algebra that soon evolved into what is now called Boolean algebra, in which the only numbers were 0 and 1. Boolean algebra is the starting point of mathematical logic and has important applications in electrical engineering and computer science. Augustin-Louis Cauchy, Bernhard Riemann, and Karl Weierstrass reformulated the calculus in a more rigorous fashion. Also, for the first time, the limits of mathematics were explored. Niels Henrik Abel, a Norwegian, and Évariste Galois, a Frenchman, proved that there is no general algebraic method for solving polynomial equations of degree greater than four (Abel–Ruffini theorem). Other 19th-century mathematicians used this in their proofs that straight edge and compass alone are not sufficient to trisect an arbitrary angle, to construct the side of a cube twice the volume of a given cube, nor to construct a square equal in area to a given circle. Mathematicians had vainly attempted to solve all of these problems since the time of the ancient Greeks. On the other hand, the limitation of three dimensions in geometry was surpassed in the 19th century through considerations of parameter space and hyper complex



Carl Friedrich Gauss.

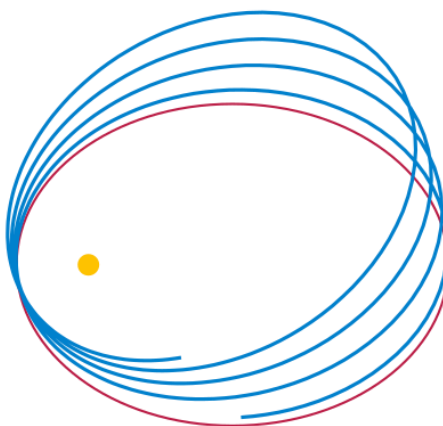
20th century - The 20th century saw mathematics become a major profession. By the end of the century, thousands of new Ph.D.s in mathematics were being awarded every year, and jobs were available in both teaching and industry. An effort to catalogue the areas and applications of mathematics was undertaken in Klein's encyclopedia. In a 1900 speech to the International Congress of Mathematicians, David Hilbert set out a list of 23 unsolved problems in mathematics. These problems, spanning many areas of mathematics, formed a central focus for much of 20th-century

mathematics. Today, 10 have been solved, 7 are partially solved, and 2 are still open. The remaining 4 are too loosely formulated to be stated as solved.



A map Illustrating the Four Color Theorem

Notable historical conjectures were finally proven. In 1976, Wolfgang Haken and Kenneth Appel proved the four color theorem, controversial at the time for the use of a computer to do so. Andrew Wiles, building on the work of others, proved Fermat's Last Theorem in 1995. Paul Cohen and Kurt Gödel proved that the continuum hypothesis is independent of (could neither be proved nor disproved from) the standard axioms of set theory. In 1998 Thomas Callister Hales proved the Kepler conjecture.

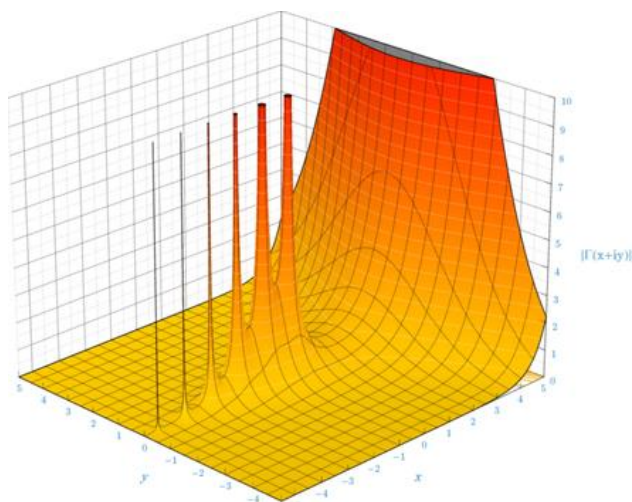


Newtonian (red) vs. Einsteinian orbit (blue) of a lone planet orbiting a star, with relativistic precession of apsides

Difference geometry came into its own when Albert Einstein used it in general relativity. Entirely new areas of mathematics such as mathematical logic, topology, and John von Neumann's game theory changed the kinds of questions that could be answered by mathematical methods. All kinds of structures were abstracted using axioms and given names like metric spaces, topological spaces etc. As mathematicians do, the concept of an abstract structure was itself abstracted and led to category theory. Grothendieck and Serre recast algebraic geometry using sheaf theory. Large advances were made in the qualitative study of dynamical systems that Poincaré had begun in the 1890s.

Measure theory was developed in the late 19th and early 20th centuries. Applications of measures include the Lebesgue integral, Kolmogorov's axiomatisation of probability theory, and ergodic theory. Knot theory greatly expanded. Quantum mechanics led to the development of functional analysis. Other new areas include Laurent Schwartz's distribution theory, fixed point theory, singularity theory and René Thom's catastrophe theory, model theory, and Mandelbrot's fractals. Lie theory with its Lie groups and Lie algebras became one of the major areas of study.

But the same time, deep insights were made about the limitations to mathematics. In 1929 and 1930, it was proved the truth or falsity of all statements formulated about the natural numbers plus either addition or multiplication (but not both), was decidable, i.e. could be determined by some algorithm. In 1931, Kurt Gödel found that this was not the case for the natural numbers plus both addition and multiplication; this system, known as Peano arithmetic, was in fact incomplete. (Peano arithmetic is adequate for a good deal of number theory, including the notion of prime number.) A consequence of Gödel's two incompleteness theorems is that in any mathematical system that includes Peano arithmetic (including all of analysis and geometry), truth necessarily outruns proof, i.e. there are true statements that cannot be proved within the system. Hence mathematics cannot be reduced to mathematical logic, and David Hilbert's dream of making all of mathematics complete and consistent needed to be reformulated.



. The absolute value of the Gamma function on the complex plane

One of the more colorful figures in 20th-century mathematics was Srinivasa Aiyangar Ramanujan (1887–1920), an Indian autodidact who conjectured or proved over 3000 theorems, including properties of highly composite numbers, the partition function and its asymptotics, and mock theta functions. He also made major investigations in the areas of gamma functions, modular forms, divergent series, hypergeometric series and prime number theory.

As in most areas of study, the explosion of knowledge in the scientific age has led to specialization: by the end of the century there were hundreds of specialized areas in mathematics and the Mathematics Subject Classification was dozens of pages long.

21st century - In 2000, the Clay Mathematics Institute announced the seven Millennium Prize Problems, and in 2003 the Poincaré conjecture was solved by Grigori Perelman (who declined to accept an award, as he was critical of the mathematics establishments)

Future - There are many observable trends in mathematics, the most notable being that the subject is growing ever larger, computers are ever more important and powerful, the application of mathematics to bioinformatics is rapidly expanding, and the volume of data being produced by science and industry, facilitated by computers, is expanding exponentially.

1.2.5 Importance of Mathematics in School Curriculum

I. Decision-Making: Mathematics is a significant area of study. It is observed that the subject is introduced from primary Education itself taking its need into account. It is expected that the students should develop a keen Interest in Mathematics to carry out daily tasks effectively and confidently. It Is one of the most Valuable tools to convert abstract ideas into concrete reality. For example, the results of Class 10 are Primarily available in the form of numbers. However, we can derive the conclusions after processing The numbers. Finally, the success ratio can be calculated and rankings are possible. Here Mathematics . Empowers you to make decisions in a real way.

II. Experiential Learning: It is said that experience is the most expensive thing in the world. Mathematics gives the students direct exposure to learn and apply the learning inputs then and there itself. These experiences help to promote interest in the minds of learners. The students learn better in groups. This is because peer learning develops lateral thinking patterns which leads to thought-provoking ideas

III. Logical Reasoning : It is Mathematics that can help the students to develop their logical and reasoning abilities. The students have to compare and contrast while solving different problems. There is huge scope where in they come across various situations. the teacher can provide useful knowledge through inductive and deductive reasoning approaches. It is recommended that the teacher should give a live demonstration of various examples to be solved. When they know the methods of solving the problems, only then they can solve them.

IV. Increasing Knowledge-Base: It is said, “Knowledge is power!” When any student is interested to learn new things, he or she can enjoy a particular subject. Consistency in the study and regular practice makes them knowledgeable. It established a strong foundation for the coming years. The basic concepts are learned appropriately and accurately (NCERT, 2005).

V. Step-By-Step Approach: We would agree that Mathematics is solving problems in a step-by-step manner. Here, it is worth mentioning that initially, any problem seems to be too difficult to solve. However, if we start working on it step-by-step, we get confidence after solving small steps one after another. The motivation factor plays a crucial role in teaching-learning processes. Here, the maxim of ‘Known to unknown’ can be applied by the teachers. When a Mathematics teacher solves the problems on the whiteboard, the learning experiences are brought within the reach of learners with the highest possibilities. Naturally, psychological barriers like ‘fear of failure’ are removed from their minds (Roes, 1992)

1.2.6 Methods for Teaching Mathematics:

When we talk about a method of instruction, we mean how content is being taught. This runs the gamut from style of instruction for example, lecture vs. hands-onto materials used. Here are some tried and true methods for teaching math:

Use Visuals: Many students need to see a lesson in addition to hearing it. While explaining an operation or skill, use a visual or graphic to help get the point across. This can be as simple as showing the lesson on a document camera or as savvy as using a video or other technology tool. Note that children do best when instruction is paired with a visual; using a visual as a stand-alone teaching device isn't always effective. Vary your usage to keep students engaged. Make connections our brains are machines that thrive on connections. In fact, long-term memory is a complicated web of neurons, or brain cells, banded together. To help students make sense of concepts, provide them with connections to the real world or previously taught lessons. Always begin a new lesson with a reminder of the last. For example, you might say, 'Yesterday, we learned about the numerator in fractions. Today, we'll take a closer look at the other part of a fraction: the denominator.'

Use Assessments: Math is typically a progression-based subject. Skills build one upon another, and the order in which they're taught is predetermined. Because of this, a math teacher doesn't have to think much about what to teach when, but it is necessary to use assessments to determine student understanding. Formative assessments, or informal assessments meant to check in on student learning and drive future instruction, should be used frequently. This can help teachers identify students who struggle and allow additional small group or one-on-one instruction.

1.2.7 Necessary Activities for Development of Thinking Style in Children

Use of a variety of activities – Children have mathematics related experiences before coming to school – they arrange things at home, walk on nearby roads, look at quantities of food, fill water, clean etc. . I don't know how much mathematical experience is hidden in such daily activities, yet we find that learning mathematics remains very difficult. To deal with this situation, it is necessary to use appropriate activities because while doing the activities, children use their mind which develops their thinking power. One special thing about the activities is that they attract the children.

Moving from gross to subtle – For the development of thinking in children in mathematics, it is necessary that we should move from gross (any solid shape) to subtle (i.e. the picture of that shape or its symbol) so that children The development of thinking power should gradually increase. Concrete objects are a powerful medium to strengthen children's understanding and thinking. Children naturally play with different types of things, assemble them, destroy them, put them back together again. In this process, all their senses remain alert which increases their thinking level.

Developing concepts after exposure to examples – One aspect that impacts the teaching of mathematics is how a concept is developed. If we show a child a banana tree and a mango tree, both are different. The child shows them differently and gives the status of trees to both of them. This is because there are some similar qualities between them. Whereas visually there is a big difference between the two. The concept of a tree consisting of these similar properties is actually present in our mind and hence is called abstract. To understand the concept of 'tree' it is important that we do not depend on a single tree. Bring the child in contact with many types of trees and tell the child about the similar properties of trees and tell other trees, like coconut tree, that due to these similar properties it is also a tree. In mathematics, children should be given a chance to come in contact with many examples of every concept, so that the concept can develop with its help.

Making guesses and verifying – To develop thinking power, children should be encouraged to make guesses and then verify them in any activity. For example, the teacher should keep some seeds in his fist and ask the children how many seeds will be there in his hand. Children will think about how many seeds can fit in their fist and then give an estimate, then verify this by actually counting the seeds and see how close the children's estimate is to the actual number. In this way the thinking power of children will develop.

Opportunities for expression in mathematical activities – If the teacher encourages the children to talk about the mathematical process, what they did in that mathematical activity, in what order they did it and why they did it that way? So their thinking power will definitely develop.

Participation of children in mathematical activities – Development of thinking power in children is possible only when every child ensures his participation in mathematical activities. If the teacher is conducting a mathematical exercise or solving a question, then some children do not participate because they do not know mathematics, hence the teacher should ensure their participation.

In this way, the study of mathematics not only strengthens the practical aspects of the child. At the same time, thinking and reasoning power develops in the child, due to which later on, they progress in their life and also contribute to the development of the society.

1.3 Development of Vedic Mathematics

1.3.1 Introduction of Vedic Mathematics

Vedic Mathematics is a science that its founder claims was lost due to the advent of modern Mathematics. Vedic Mathematics is said by its founder to be a gift given to this world by the ancient sages of India, though there is no historical evidence whatsoever for this claim. It is a system for limited arithmetic and polynomial calculation which is simpler and more enjoyable than the equivalent algorithms of modern mathematics.

Vedic Mathematics is a collection of ancient tricks and techniques to execute arithmetic operations quickly and more efficiently. Vedic Mathematics comes from the Vedas, more specifically the **Atharva Veda**. It was revived by Indian mathematician Jagadguru Shri Bharati Krishna Tirthaji between 1911 and 1918. He then published this work in a book called Vedic Mathematics in 1965. It comprises 16 sutras (formulae) and 13 sub sutras.

1.3.2. Meaning and uses of 16 Sutras of Vedic Mathematics

Vedic Mathematics these days is gaining popularity because of its speedy and accurate calculations. Calculations are an integral part of any profession today and the ability to do it quickly and accurately definitely is an important skill that anyone would desire to have.

Vedic Maths is based on sixteen sutras, which were unravelled by Swami Bharati Krishna tirtha Ji Maharaj, the Shankaracharya of Govardhan peeth, puri. The Atharvaveda is said to have lots of information on science and mathematics and it is from there, Shankaracharya of Goverdhan peeth puri, decoded the whole information and presented it in the form of 16 sutras.

Through this article, an attempt has been made to bring this knowledge to you in a simple and lucid language, with examples.

1.3.3 The 16 Sutras

EKADHIKENA PURVENA: (by one more than the previous)

Very useful in finding the product of numbers, if the sum of unit digits of the two numbers totals to 10.

e.g $24 \times 26 = ?$

$= (\text{first digit} \times \text{one more than first digit}) (\text{product of unit digits of both the number})$

$= (2 \times 3) (4 \times 6)$

$= 6 \ 24$

So, $24 \times 26 = 624$. The answer has come without doing any elaborate calculation.

NIKHILAM NAVATASHCARAMAM DASHATAH: (all from 9 and last from 10)

This sutra is very commonly used in the subtraction of a number from the powers of 10.

Eg. 10000

$- \quad 7688$

2312

- The last number is 8 and this is subtracted from 10 and the next 8 is subtracted from 9, all other numbers are subtracted by 9 and the result comes out almost orally.

URDHVA-TRIBHAGYAM: (vertically and crosswise)

This is used for multiplications and the formula used is explained below.

$ab \times cd = (ac) (ad + bc) (bd)$

$24 \times 12 = (2 \times 1) (2 \times 2 + 4 \times 1) (4 \times 2)$

$2 \ 8 \ 8$

And the answer is 288.

PARAVARTYA YOJAYET: (Transpose and adjust)

This is used to solve division problems when the divisor is a little greater than the nearest power of 10.

Let us see this division $434 / 12$.

$$\begin{array}{r} 12 \\ \overline{) 2} \end{array}$$

$$\begin{array}{r|l} 43 & 4 \\ \hline 8 & 10 \\ \hline 45 & 14 \\ \hline 35 & 14 \end{array}$$

The first thing to be noted is that divisor 12, is near 10, so the above sutra can be applied. Look at the divisor and check how many digits it has. In this case, it is having 2 digits. So according to this sutra, the dividend should be split into two parts 43 and 4 and the working is as below.

As shown above, the divisor is written and leaving 1 apart, 2 is taken down as 2 bar, i.e. vinculum 2.

The dividend is divided into two parts 43 and 4. 4 of 43 is taken down and to this four, the vinculum 2 is multiplied to get vinculum 8 which is written under 3 of 43. 3 vinculum 8 would be vinculum 5 which is taken down. Vinculum 2 of the divisor is multiplied with this vinculum 5 and the result 10 is written under 4 and totaled to 14.

14 is taken down as it is. Now 45 is a vinculum number because 5 is vinculum. According to Vedic Maths rules vinculum, 5 is complemented with 10 to get normal 5 which is taken down. The number next to the vinculum number should be reduced by 1. So, 4 becomes 3 and comes down

And the answer is quotient=35 and remainder=14 when $434/12$.

SHUNYAM SAAMYASAMUCCAYE: (When the sum is the same. That sum is zero)

This is used to solve equations in the form

$$a. \quad Ax + b = cx + d$$

Can

$$\text{So } x = d - b / a - c$$

$$b. \quad (x+a)(x+b) = (x+c)(x+d)$$

$$\text{So } x = cd - ab / a + b - c - d$$

Some applications

1. A term which occurs as a common factor in all the terms is equated to zero. e.g. : $14x + 9x = 4x + 12x$

Here x occurs as a common factor with all terms and hence the value of x according to this sutra is zero.

2. If the product of the independent term on either side of the equation is equal the value of the variable will be zero, which is the second interpretation of this sutra. a

$$(x + 8)(x + 3) = (x + 12)(x + 2)$$

$$8 \times 3 = 24 = 12 \times 2 \text{ and hence value of } x \text{ in this equation would be } 0$$

ANURUPYE SHUNYAMANAT: (If one is in ratio the other is equal to zero. This is also used to solve equations.)

Suppose:

$$2x + 4y = 8 \text{ and}$$

$$4x + 6y = 16, \text{ the ratio of terms with } x = 2x/4x = 1/2$$

$$\text{The ratio of the R.H.S term is also } 8/16 = 1/2$$

Therefore, the other variable, in this case $y = 0$

Substituting this value of y in any other of the two equations, we can get value of x

$$2x + 4(0) = 8$$

$$2x = 8$$

Therefore $x = 8/4 = 2$.

SANKALANA-VYAVAKALANABHYAM: (By addition and subtraction)

This sutra is used to solve equations. (if the coefficient of 1 variable is same in both the equation irrespective of the sign)

What it means is that the coefficient of the 1 variable in equation 1 should be equal to the coefficient of the 2nd variable in the second equation and the coefficient of the 2nd variable in equation 1 should be equal to the coefficient of 1st variable in equation 2. Then the two equations can be added and subtracted and solved for variables

For e.g

$$4x + 2y = 6 \dots\dots\dots \text{equation 1 and}$$

$$2x + 4y = 7 \dots\dots\dots \text{equation 2. Now add equation 1 and 2 we get}$$

$$6x + 6y = 13 \text{ or}$$

$$6(x + y) = 13 \text{ or}$$

$$X + y = 13/6 \dots\dots\dots \text{eq 3. Subtract equation 2 for eq 1}$$

$$2x - 2y = -1$$

$$2(x - y) = -1 \text{ or}$$

$$X - y = -1/2 \dots\dots \text{eq 4} \dots\dots \text{therefore}$$

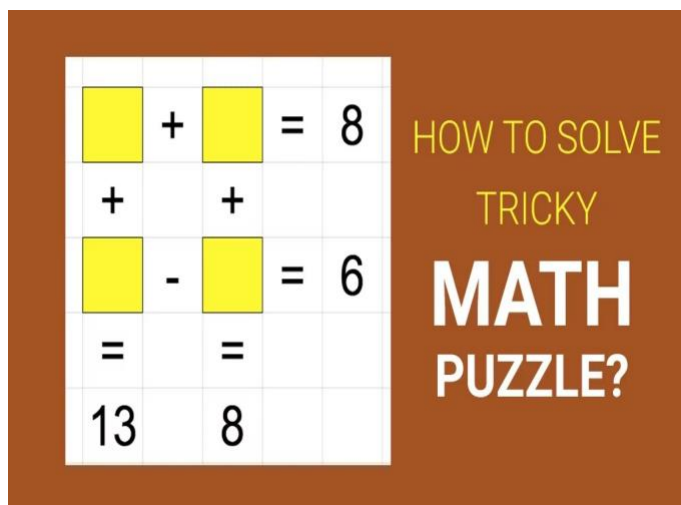
$$Y = x + 1/2 \dots\dots\dots \text{eq 5 substitute this in equation 3. So we get}$$

$$X + (x + 1/2) = 13/6 \dots \text{solving for x, we get}$$

$$X = 19/12 = 1.58 \dots\dots$$

$$\text{And } y = x + 0.5 \dots \text{from eq 5}$$

$$\text{So, } y = 1.58 + 0.5 = 2.08$$



PURANAPURANABHYAM: (By the completion or non-completion)

This can be used to solve addition problems when the unit digits of the numbers add up to 10 for e.g. number 22 and 18 the unit digits add up to 10. Let try to add

$$295 + 46 + 28 + 15 + 44 + 22 = ?$$

Now we need to check and number and pair them in such a way that their unit places add up to 10. So....

$$295 + 46 + 28 + 15 + 44 + 22 = ?$$

Rearrange to put the paired number together.

$$(295 + 15) + (46 + 44) + (28 + 22)$$

$$300 + 90 + 50 = 440.$$

This happened in easy steps instead of long calculations

CHALANA KALANABHYHAM: (difference and similarities)

The application of this sutra can be found in calculus to find roots of a quadratic equation and the second application is in differential calculus for factorizing 3rd, 4th, and 5 degrees expression. This sutra finds very specialized applications in the area of higher mathematics .

YAVADUNAM: This is used to find squares of numbers that are close to the powers of base 10. Compare the number with the closed base to it and find the deficiency or excess. Square the difference and this is one part of the answer, reduce the given number or increase it by the difference it has to the power of base 10

Let us understand this with an example.

Let us try to find the square of 12

12 is near to 10 and it is 2 excess than 10.

1. Square the difference (excess in this case). So $2 \times 2 = 4$this is the unit place
2. Now add the excess to the number. The number is 12 so $12 + 2 = 14$...this is the left part of the answer
3. Combining both of them we get=144
4. Solving it in equation form
5. $12^2 = (12 + 2)(2) = 144$

VYASHTISAMANSTIH: (Part and whole)

This helps in the factorization of quadratic equations.

SHESANYANKENA CHARAMENA: This sutra gives you the process of converting fractions to decimals.

For eg $1/29$

1. The last digit of the divisor should be 9. It is in this case, now increase the value by 1 of the number next to 9. So, the number is 2 and increasing it by 1 makes it 3
2. The dividend is 1 now it has to be divided by 3 so,
3. $1/3$
4. Doing it mentally it will be 0.0 and remainder 1 and it is written as
5. 0.10 and 10 is divided by 3 and it will be written as 3 and remainder 1 written to left
6. 0.1013 now 13 is to be divided by 3 and it will be written as 4 and remainder 1 written to left
7. 0.101314 and keep on dividing it by 3 to as many decimal places as needed. For three decimal places the answer is 0.034

SOPAANTYADVAYAMANTYAM: (The ultimate and twice the penultimate.)

This sutra is used to find solution of equations in the following form

$$1/ab + 1/ac = 1/ad + 1/bc$$

Where a, b, c and d are in arithmetic progression

$$B = a + z$$

$$C = a + 2z$$

$$D = a + 3z$$

Solution for such equations is $2c + d = 0$

e. g.

$$1/(x+1)(x+2) + 1/(x+1)(x+3) = 1/(x+1)(x+4) + 1/(x+2)(x+3)$$

Now according to the above sutra the solution would be

$$2(x+3) + (x+4) = 0$$

$$2x + 6 + x + 4 = 0$$

$$3x + 10 = 0$$

$$x = -10/3$$

EKANYUNENA PURVENA: (By one less than the previous.)

Multiplication can be done using this sutra.

The product of two number can be calculated using this sutra when the multiplier consists of only 9

For example $12 \times 99 = ?$

The process to do it is

1. Reduce 1 from multiplicand ie. $12 - 1 = 11$
2. The other part of the answer would be $99 - 11 = 88$ (complement of 99)

Hence the answer is 1188

GUNITA SAMUCHAYA: It is used to find the correctness of the answers in factorization problems and it states that the sum of the coefficients in the product is equal to the sum of coefficients of the factors and if this condition is satisfied then the equation can be considered to be balanced.

For eg let us consider a quadratic equation

$$8x^2 + 11x + 3 = (x+1)(8x+3)$$

In this case, the sum of coefficients is $8+11+3=22$

Product of the sum of coefficients of the factors $= 2(8+3) = 2 \times 11 = 22$

Since both, the totals tally the equation is balanced and correct.

GUNAKASAMUCHYA: (The factor of the sum is equal to the sum of the factors.)

This sutra holds good for a perfect number.

Let us find the factors of number 28,

$$1 \times 28 = 28$$

$$2 \times 14 = 28$$

$$4 \times 7 = 28$$

So, in this case, the sum of factors is $1+2+4+7+14=28$

The sum of factors equals the factor of the sums, so 28 is said to be a perfect number.

All the sutras and sub sutras of Vedic maths help to perform mathematical operations quickly and accurately

S.No	Sutras	Sub-sutras
1	Ekadhiken Purvena	Anurupyena
2	Nikhilam Navatacharamam Dasatah	Sisyate Sesajnah
3	Urdhva-tiryagbhyam	Adyamadyenantya-mantyaena
4	Paravartya Yojayet	Kevalaih Saptakam Gunyat
5	Sunyma Samyasamuchaye	Vestanam
6	(Anurupye) Sunyamanyat	Yavadunam Tavadunam
7	Sankalana- vyavakalamnabyam	Yavadunam Tavadunikrtya Varganca Yojayet
8	Puranapurabhyam	Antyayoradaskaepi
9	Chalana-Kalanabhyam	Antyayoreva
10	Yavadunam	Samuccayagunita
11	Vyastisamastih	Lopanasthapanabhyam
12	Sesanyankena Caramena	Vilokanam
13	Sopantyadvayamantyam	Gunitasamuccayah Samuccayagunitah
14	Ekanyunena Purvena	
15	Gunitasamuccayah	
16	Gunakasamuccayah	

1.3.4 Why is Vedic Mathematics called Vedic Mathematic

Before Macaulay's education system was adopted in India, mathematics was taught in Indian schools according to Vedic Mathematics. It is a different matter that these methods have been developing since the Vedic period.

In India, mathematics education was given to students in Gurukul since ancient times. Evidence of this is also found in Kautilya's Arthashastra. According to Kautilya, after Chudakarma, the student should have the knowledge to learn script and numbers. The inscription at Hathigumpha reveals that Kalinga King Kharavela had spent nine years of his life in learning script and drawing, geometry and arithmetic. Prince Gautam also learned mathematics at the age of eight. Even in Jain texts, there are formulas for studying mathematics in the Vedic manner.

Vedic Mathematics in India had started from the Vedic period, but its existence is believed to be from the 20th century. Therefore, mathematics has enjoyed the highest position here since the Vedic period. The credit for the re-discovery of Vedic mathematics goes to Shankaracharya Swami Shri Bharati Krishnatirtha Ji of Puri, who after studying the ancient Vedas, wrote a book named 'Vedic Mathematics' in 1958 and this book was published in 1960. The Vedas were written 5000 BC. These Vedas have compiled many researches and formal conversations on the subject of Vedic Mathematics thousands of years ago.

This is the reason why this mathematics has been named Vedic Mathematics.

1.3.5 Vedic Mathematics: A Student's Guide

Vedic Mathematics is an ancient mathematical system belonging to the Indian mathematical tradition. Its aim is to make the study of mathematics simple, fast and effective. In the name of Vedic Mathematics, there are techniques based on the isolated knowledge of Vedic codes. It uses various mathematical commands, transformations and equations between numbers. Studying Vedic Mathematics helps students to improve mathematical skills as well as develop mental mathematical ability and problem solving ability. Using its methods, calculations between numbers, ratios, algebra, least common multiples and many other mathematical problems can be solved simply and quickly.

The father of Vedic Mathematics is Shri Bharat Krishna Tirthaji. He compiled various principles of Vedic Mathematics and presented them in a simple language, blending them with modern culture. His major contribution is in teaching the simplicity, dynamism and speed of Vedic Mathematics in an effective manner. Studying the methods he developed helps students better understand and apply the rules of mathematics. Bharati Krishna Tirthaji is considered a strong propagator and admirer of Vedic Mathematics.

The reason for studying Vedic Mathematics is that it provides students with the ability to easily understand the rules of mathematics and use them effectively. It is the art of making simple, fast and effective calculations which enhances the mathematical skills of students. By using its methods, they develop the ability to solve math problems faster as well as make connections between numbers and logical thinking. Its study provides students with mathematical morale, self-confidence and the ability to solve problems uniquely.

To summarize, the importance and benefits of Vedic Mathematics are that it develops students' mathematical skills, numerical ability, ingenuity, quickness, combination ability, morale and multidimensional thinking. Its study provides them with the ability to deeply understand and effectively use the rules of mathematics. Vedic Mathematics provides students with independent psychological thinking, unique solutions to problems, and the ability to solve various mathematical problems rapidly.

1.3.6 Vedic Mathematics Tricks

Vedic maths has many tricks to perform different mathematical operations such as addition, subtraction, multiplication, division, squares, square roots, etc. All these tricks help to compute the numerical problems in very little time when compared to the normal maths procedures. Vedic maths tricks reduce the time in finishing the calculations and create interest in learning more such tricks. Let's have a look at some of the tricks along with examples for a better understanding here.

1.3.6.1 Vedic Mathematics Addition Tricks

We have various tricks to perform the addition in Vedic maths. In this section, you will learn how to add numbers using one of the sutras called Ekadhikena Purvena with the help of an example.

Example:

Compute: $98765 + 63217 + 89522 + 60543$

Or

By Sutra Ekadhikena Purvena, add 98765, 63217, 89522, and 60543.

Solution:

Steps for adding numbers using Ekadhikena Purvena Sutra:

Step 1: Write the given numbers in rows and columns by giving some space between the digits.

Step 2: Column I (from the right side), add the first two digits, $5 + 7 = 12$

Step 3: Mark Ekadhika dot(.) on 1, (digit which is next to 7 in column II)

Step 4: Now, start again adding with 2;

$$2 + 2 = 4$$

Again start with 4 such that $4 + 3 = 7$

Step 5: Write 7 below at the answer's place

Step 6: Add the remaining columns in the same way.

$$\begin{array}{r}
 98765 \\
 \dot{0}\dot{6}32\dot{1}7 \\
 \dot{0}\dot{8}\dot{9}\dot{5}22 \\
 \dot{0}6\dot{0}543 \\
 \hline
 312047
 \end{array}$$

Thus, the final answer will be obtained as:

1.3.6.2 Vedic Mathematic Subtraction Tricks

Subtraction can be performed using 4 or 5 different methods in Vedic mathematics, and the best, as well as easiest way to subtract the numbers, is the Sutra Ekadhikena Purvena and Param Mitra Unka (the best friend). Here,

two digits are called each other's best friends if their sum is equal to 10. For example, 3 is the best friend of 7 since $3 + 7 = 10$.

Go through the example given below to understand the subtraction of numbers by Sutra Ekadhiken Purvena.

Question:

Subtract 389 from 746.

Solution:

Steps for subtraction in Sutra Ekadhiken Purvena:

Step 1: Write the given numbers in rows and columns by giving some space between the digits.

Step 2: Consider column I (from the right end), 9 is greater than 6 so we cannot subtract it from 6.

1 is the best friend of 9 and add 1 to 6, i.e. $1 + 6 = 7$. So write 7 in the answer place and mark Ekadhika dot(.) on 8, which is in the same row of column II such that it becomes 9 (as $8 + 1 = 9$).

Here, dot(.) on the number represents one more than the previous number.

Step 3: Similarly, we need to subtract the remaining numbers. Thus, the answer will be:

Vedic maths subtraction

Therefore, $746 - 389 = 357$.

1.3.6.3 Vedic Maths Multiplication Tricks

Like addition and subtraction, multiplication can also be done using different sutras in Vedic maths. In this section, you will learn two simple methods of multiplying numbers along with examples.

Method 1:

In this method, we can multiply the numbers whose unit digits are added up to 10 or powers of 10.

Let's have a look at the solved example given below to understand the multiplication of numbers.

Example:

Multiply 63 and 67.

$$63 \times 67$$

$$\text{Sum of unit digits} = 3 + 7 = 10$$

$$\text{Digits in tens places} = 6$$

So, we can write the multiplication as:

$$63 \times 67 = 6 \times (6 + 1) \times 7$$

$$= 6 \times 7 \times 7 = 42 \times 7 = 4221$$

This method of multiplication is referred to as the Sutra Ekadhiken Purvena. This method can also be used to multiply two numbers whose last two digits are added up to 100, the last three digits are added up to 1000. Also, in the case of mixed fractions, the sum of proper fractions must be added up to 1 to apply this method of multiplication.

1.4 Need of the Study

Nowadays it is often seen in the educational field that one has to face innumerable difficulties and problems in teaching Mathematics. Vedic Mathematics is not just Mathematics but a cultural heritage. It is the sacred duty of us Indians to preserve it. The main objective of this work is to bring to light the intellectual property of ancient India. Vedic Mathematics was not known to the world but with increasing interest in the ancient Sanskrit text, Vedic Mathematics was rediscovered in 1911 by Goswami Bharati Krishna Tirtha Ji (former Shankaracharya of Puri). Swami Bharati Krishna Tirtha ji was a great scholar of Sanskrit, Mathematics, History and Philosophy. His deep study and meticulous research led to the discovery of the great mathematical formulas known as Sanskrit sutras, which were completely ignored until now because no one could link them to the Vedic Mathematics which Bharati Krishna Tirtha Ji is a function, SE is the key of Mathematics. It is considered to be the first work in the direction of Vedic Mathematics.

A copy of his book reached London in the late 1960s and from there Vedic Mathematics was reborn. It was taken as a new alternative system of Mathematics. British Mathematicians were interested in Vedic Mathematics. Several lectures were given on this, which were later published in the book Introductory Lectures on Vedic Mathematics. After Andrew Nicholas's visit to India between 1981 and 1987, interest in Vedic Mathematics began to develop in India and this gave a new perspective to Vedic Mathematics.

Vedic Mathematics is the fastest process in the world, it is 10 to 5 times faster than normal Mathematics. There are unique methods of calculation in Vedic mathematics which are based on simple formulas. Therefore, its purpose is to save time and make calculations.

It is very important to teach Vedic Mathematics at school level. The aim of Vedic Mathematics is to develop the art of calculation at a rapid pace in children up to class eight. Essentially, the main objective of starting Vedic Mathematics at the school level is to develop the brain of every child and then he can reveal his intelligence through the use of Vedic Mathematics.

The main objective of bringing Vedic mathematics into practice is to save our Indian culture. How many great mathematicians have there been in our country? Today we do not use the formulas created by them even though the entire mathematics can be solved by them, the main reason for this is the influence of western culture. Modern mathematics cannot save much time nor is it helpful in raising the mental level of the students. Zero decimal etc. were discovered in India. Therefore, the advice of Vedic mathematics is to revive our Indian Sanskrit.

1.5 Statements of the Problem

The problem statement of the present study is as follows-

“A Study of Practical Applications of Vedic Mathematics”

1.6 Definition of Terms Used in the Study

1.6.1 Study – the activity or process of learning about something by reading, memorizing facts, attending school, etc.

1.6.2 Practical –The practical aspects of something involve real situations and events, rather than just ideas and theories.

1.6.3 Application– A way in which something can be used for a particular purpose.

1.6.4 Vedic Mathematics– Vedic Mathematics is a collection of Methods or Sutras to solve numerical computations quickly and faster. It consists of 16 Sutras called Formulae and 13 sub-sutras called Sub Formulae, which can be applied to the solving of problems in arithmetic, algebra, geometry, calculus, conics, etc. All the sutras and sub sutras of Vedic maths help to perform mathematical operations quickly and accurately.

1.7 Objectives of the Study

- To Study books of Vedic Mathematics.
- Selecting interesting applications of Vedic mathematics for students.
- To present suggestions for inclusion of selected experiments of Vedic mathematics in mathematics text books.
- To identify educational Implementations of study.

1.8 Delimitations of the Study

For research it is necessary to have a research problem. To make the problem more clear, it is necessary to define the boundaries. So that the path to the goal becomes clear. Therefore, to avoid unnecessary detail, the limitations of the presented research work have also been determined by the researcher as follows.

- The research study presented will be limited to the textbooks of the National Council of Educational Research and Training.

1.9 Research Method

In the presented mini-research, the subject matter has been studied according to the subject matter of the study.

Content Analysis Method

Content analysis is also called document analysis. In this, the researcher does not collect the ideas obtained through interview, observation or questionnaire regarding the event or person to be studied, but comes to the conclusion by analyzing the documents collected about such events or communications made by people or their

behavior. While defining content analysis, Kerlinger has said that content analysis is a method of analyzing and studying communications in a systematic, objective and definitional manner to measure variables.

According to Holsti, content analysis is a method of making inferences by systematically and objectively identifying the specific properties of information. Berelson has also defined content analysis in the following way – “Content analysis of communications. It is a research technique for providing objective, systematic and quantitative description of the subject matter.

1.10 Importance and Significance of the Study

Can we even imagine a day in our lives without mathematics? This is impossible because even to solve the problems of daily life we have to depend on mathematics in some form or the other. Mathematics is an important tool in connecting us with the environment around us and increasing our understanding of the world. Mathematics is all around us like a natural end which we can easily experience. Any person, be it a laborer, farmer, businessman, housewife, doctor, lawyer, uses the numbers and principles of mathematics every day. In office, newspaper, playground, mathematics is present everywhere. Every person needs mathematics directly or indirectly to earn his living. We can easily solve many types of problems of our daily life through mathematics.

There are many benefits of learning Vedic mathematics. Students develop problem solving abilities and it also leads to the development of creative intelligence.

Students of Vedic Mathematics can not only do simple calculations of addition, subtraction and multiplication. But can also perform very complex calculations like algebra, geometry and trigonometry. Our brain works more creatively with Vedic Mathematics hence mental sharpness is also associated with it. Vedic Mathematics is very effective and also it is easy to learn.

Only 16 Vedic sutras are used to solve mathematics problem. Sutas are basically words that describe the general way of solving mathematical problems.

Calculations cannot be done very fast using traditional methods taught in schools. It teaches students to solve the same problem in different ways.

In this way, the usefulness, significance and reliability of Vedic mathematics is immense. Vedic mathematics is a gift given by our Indian mathematician. Which we need to expand further.

Chapter II

Survey of Related Literature



2.1 Introduction

2.2 Review of the Literatures of the Vedic Mathematics

2.3 Conclusion

Chapter –2

Survey of Related Literature

2.1 Introduction

The review of related literature has great importance in every kind of research work. With its help, we came to know about the work that has been done previously until we have learnt what others have done and what still remains to be done in our area, we can not contribute to furthering knowledge in our field. Review helps also in delimiting the research problem and in defining it better. The review of literature helps the researcher to develop insight and provide him an opportunity of gaining insight into the methods, measures, subjects and approaches employed by other research workers. This, in turn, will lead to significant improvement of our research design.

According to Good, C.V.; Barr, A.S. and Scates, D. E. “The key to the vast storehouse of published literature may open doors to sources of significant problems and explanatory hypotheses and provide helpful orientation for definitions of the problems, and background for selection of procedures and comparative data for Interpretation of results. In order to be truly creative and original, one must read extensively and critically as a stimulus to thinking”.

The review of related literature will give the student the insight he needs to convert his tentative research problem to a specific and concise one. The review of related literature is important to gain the knowledge of that particular field of human knowledge to have complete and thorough information of the work done in his country and abroad in the specific area of his research. Thus, the researcher needs an adequate familiarity with libraries and its many resources because the library is the storehouse of knowledge and wisdom. After the selection of the problem, the researcher started the study of the work already done in the field. He studied many articles, books, journals, bulletins, yearbooks, theses and encyclopedias, research report etc. on the topic concerned.

In the following pages an attempt has been made to present briefly some important researches and studies conducted in India and abroad, and having a significant bearing on the present study. The review of the literature pertinent to the problem of this study is organized in the following sections:

2.2 Review of the Literatures of the Vedic Mathematics

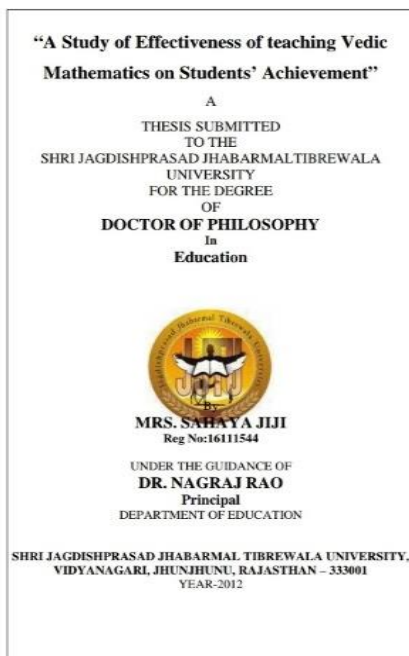
Research in the area of Vedic Mathematics has received much attention in the last 30 years. The following is a review of the research of Vedic Mathematics

MRS. SAHAYA JIJI (2012). conducted “A Study of effectiveness of teaching Vedic Mathematics on students.”

- The researcher used Random sampling technique for this study. Selection of the sample. 130 students of Lourdes high school, Kalyan (W) and Shankara Vidyalaya, Dombivili. The number of Students in each group was 65. All students were selected from 7th Class of the two schools. They were divided into boys group and Girls group. 37 boys and 28 girls were selected in the experimental Group and 41 boys and 24

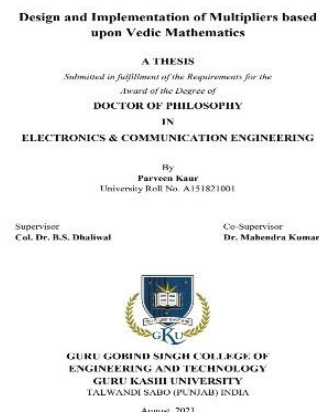
girls were selected in the control group For the study. This study was conducted in Lourdes High School, Kalyan (W) And Shankar Vidyalaya Dombivli €. All students were selected From 7th class of the two schools. For the sample of the study, Random sampling technique was used. 130 students of Lourdes High school, Kalyan (W) and Shankar Vidyalaya, Dombivli€. The Number of students in each group was 65.

- Total sample was 130, which was divided into two groups (i.e. Experimental and control) of 65 students each. Experimental group Had 65 students. And also the two groups i.e. experimental group And control group students were divided into boys group and girls Group. 37 boys and 28 girls were selected in the experimental Group and 41 boys and 24 girls were selected in the control group the study.
- Teachers should have favorable attitude towards Vedic Mathematics.
- At least some periods should be allotted in the class to use Vedic Mathematics tricks. So students can actively Participate in solving problems.
- Every Mathematics teacher should have the knowledge about Vedic mathematics.
- School should arrange guest Lectures for students. So students get inspired by the experts and try to know about Vedic Mathematics so that they can solve more problems With speed and accuracy.



Parveen Kumar (2021). conducted research on “Design and implementation of multipliers based upon Vedic Mathematics”.

- In the present work the performance of the Vedic multipliers based upon Urdhava Triyakbhayam sutra has been studied in comparison with the other multiplier such as array, Wallace tree and Dadda Multipliers in terms of area, power consumption and delay. It is observed that Vedic multiplier is efficient in terms of area, power consumption and speed of operation. Hence the Vedic Multipliers are used for the design of quadratic equation multipliers and Binary multipliers for the multiplication of BCD digits. All the multipliers are designed using VHDL, synthesized, simulated and implemented using Xilinx ISE tools.



Rajesh Kumar (2015). conducted research on “Effectiveness of Vedic Mathematics Method vis a vis Traditional Method for secondary school students in Mathematics Achievement.”

- Keeping in mind the goal of examining whether the Vedic mathematics . teaching method is more effective than lecture method or not, in terms of dependent variable like Mathematics achievement, this study was conducted. The experimental research method of two groups was used to test the teaching method as an independent variable. Necessary programs for selected Topic of Std.9 and 10 in terms of both the treatments viz. treatment of Vedic mathematics assisted teaching method on experimental group and treatment of lecture method on controlled group were prepared.
- The Mathematics achievement of boys and girls of Std. 9 and 10 who were taught by Vedic Mathematics assisted teaching method was higher than that taught by lecture method.
- The Mathematics achievement of boys and girls of Std. 9 and 10 who were taught by Vedic Mathematics assisted teaching method was higher than that taught by lecture method.

"Effectiveness of Vedic Mathematics Method vis - a vis Traditional Method for secondary school students in Mathematics achievement"

A Dissertation
Submitted for the Award of the Ph.D. degree of
PACIFIC ACADEMY OF HIGHER EDUCATION AND
RESEARCH UNIVERSITY

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Udaipur
Year of submission 2015

S.SMITHA (2011). conducted research on "Preparation of a learning package of vedic mathematics and testing its effectiveness on secondary school students computational ability and their affective domain."

- The study throws light on the fact that majority of secondary school students are under high anxiety towards mathematics learning. The reason behind this is that eventhough their conceptual understanding on the subject is good, the computational ability is very poor. The existing system of mathematics instruction is purely conceptual and it has not given any importance to computational speed and mental arithmetic.
- The results of this study suggest that along with the conceptual understanding of the subject content, the computational ability of learners should also be strengthened. But the present system fails to strengthen the computational ability of students which adversely affect the quick application Of the subject in day today life.
- The present study highlights the need of a mathematics learning strategy in which both concept and computational aspects of mathematics are given due importance in order to enhance the efficiency of mathematical thinking. Calculation speed is an essential factor which will save working memory space for thinking at a higher level and thus leads to efficiency. Vedic Mathematics provides very easy, one line, mental and superfast methods of calculation.

PREPARATION OF A LEARNING PACKAGE OF
VEDIC MATHEMATICS AND TESTING ITS
EFFECTIVENESS ON SECONDARY SCHOOL
STUDENTS' COMPUTATIONAL ABILITY
AND THEIR AFFECTIVE DOMAIN

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THESIS
SUBMITTED FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY IN THE FACULTY OF EDUCATION

UNIVERSITY OF KERALA
THIRUVANANTHAPURAM
2011

- The study also found that the prepared learning package of Vedic Mathematics is effective in enhancing the computational ability of Secondary school Students. The particular modules developed are useful in improving certain affective correlates such as mathematics interest and mathematics attitude among the students. Not only that the Vedic Mathematics is a solution to mathematics anxiety faced by students. The prepared package is also helpful to mathematics teachers as a teaching material which can capture the attention of students and thus help them to attain math maturity.

Vishnubhai M. Patel (2023) conducted research on “Effectiveness of Vedic Mathematics on Mathematical Abilities of Secondary Schools Students.”

- The domain of the present study was the Gandhinagar district. So, a list of all the Gujarati medium Secondary School had been collected. A visit of 15 representative school from the whole list was carried out. Then, the purposive selection of 5 school was done in which the Vedic Mathematics program was implementable from these school. All the students from the selected classes will be selected as samples using the random sampling technique method. And divided into two groups, as Experimental group and Control group. In this, around 404 students were included in the sample 202 students were selected in control groups and 202 students were selected in experimental groups.

Effectiveness of Vedic Mathematics on Mathematical
Abilities of Secondary Schools Students

A
Thesis Submitted to
Kadi Sarva Vishwavidyalaya University
Of Gandhinagar Gujarat



For the Degree of
DOCTORATE OF PHILOSOPHY
In
EDUCATION

By
Vishnubhai M. Patel

UNDER THE SUPERVISION OF

Dr. Veenaben Patel

Dean & Professor, Faculty of Education,
Kadi Sarva Vishwavidyalaya, Gandhinagar.

February-2023

- Twenty statements of Opinions about Vedic Mathematics the overall reaction of the experimental group students were positive towards Vedic Mathematics, therefore it can be concluded that students liked learning mathematics through Vedic Mathematics
- Significant effect was seen on the Mathematical abilities of higher achiever and lower achiever students of the experimental group after the experiment treatment. It means that significant growth was seen in the Mathematical abilities of higher achiever students of the experimental group better than the lower achiever students after the experiment treatment.

Shaifali Vyas (2020) conducted “A Study of Effectiveness of Methods of Vedic Mathematics In Context with Some Variables for Students of Standard 9th.”

- It was revealed that the Vedic techniques are more effective in teaching mathematics and achievement in mathematics can be improved. In present research the researcher has compared Vedic method with

traditional teaching method. The researcher revealed that the students treated with Vedic techniques have solved mathematics problems in less time than the students treated with traditional teaching method.

- Vedic mathematics method found more effective than traditional method on achievement of students in mathematics subject.

The main recommendations are as follows:

- The government should support and inspire educators to develop modern techniques for teaching and learning process in class rooms.
- The schools and managements should create such free environment in which a teacher could experiment new teaching methods.
- The teacher should be awarded with funds to perform educational researches.
- The schools should construct well equipped class rooms in which teachers could apply modern teaching techniques.
- The teachers and educators should bifurcate old but innovative teaching techniques and should be experimented for research work.

A Study of Effectiveness of Methods of Vedic Mathematics in Context with Some Variables for Students of Standard 9th

A Thesis
Submitted to the
GLS UNIVERSITY

For the Degree of
DOCTOR OF PHILOSOPHY
(Education)

Guide
Dr. Sonal Sevak

Researcher
Shaifali Vyas



Department of Education
GLS University
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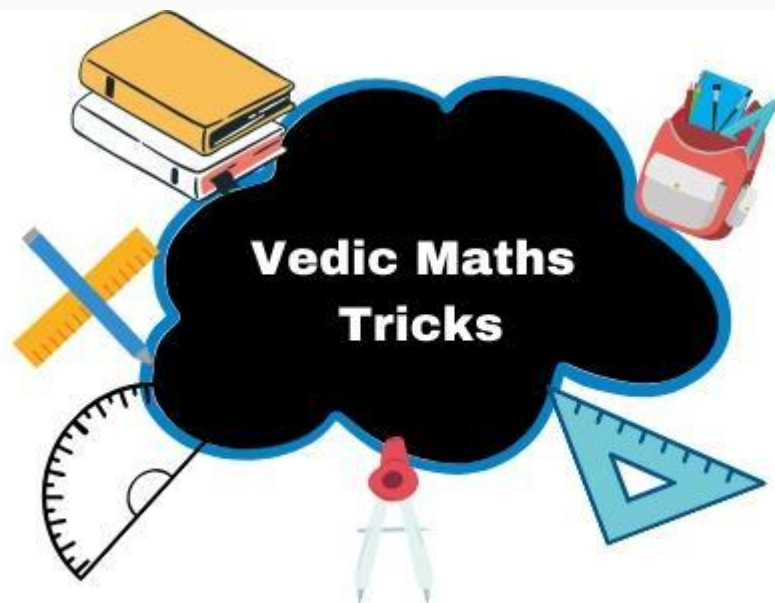
March - 2020

2.3 Conclusion

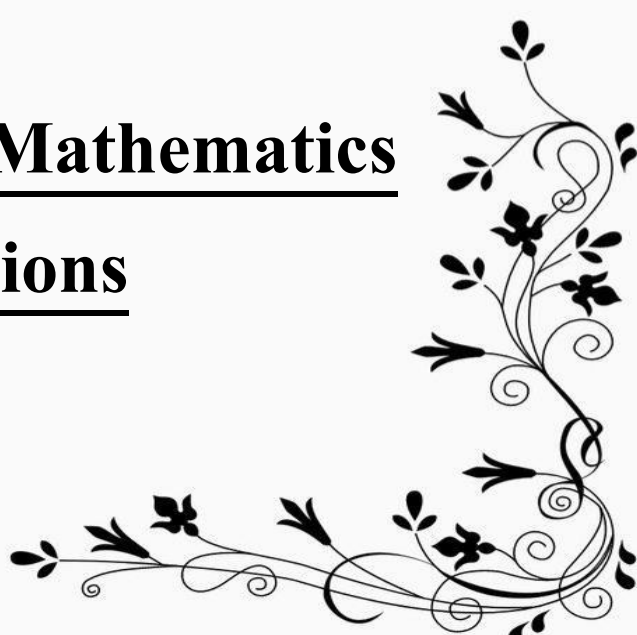
After reviewing all the related literature, the researcher found that researches on “A Study of effectiveness of teaching Vedic Mathematics on students, Design and implementation of multipliers based upon Vedic Mathematics, Effectiveness of Vedic Mathematics Method vis a vis Traditional Method for secondary school students in Mathematics Achievement, Preparation of a learning package of Vedic Mathematics and testing its effectiveness on secondary school students computational ability and their affective domain, Effectiveness of Vedic Mathematics on Mathematical Abilities of Secondary Schools Students, A Study of Effectiveness of Methods of Vedic Mathematics In Context with Some Variables for Students of Standard 9th.” Have been done previously.

The researcher further found that the research work on “**A Study on Practical Application of Vedic Mathematics**” has not yet come to light, hence the researcher got curious that selected this topic is my research work.

Chapter III



Selected Vedic Mathematics Operations



Chapter 3

Selected Vedic Maths Operations

3.1 Multiplication

Multiplication is the process of calculating the product of two or more numbers. The multiplication of numbers say, 'a' and 'b', is stated as 'a' multiplied by 'b'.

In Maths, the basic explanation of multiplication is adding a number, with respect to another number, repeatedly. We know that the repeated addition of a certain number is multiplication.

Such as: $2+2+2+2+2+2=12$

Or $6 \text{ times } 2 = 12$

Or $6 \times 2 = 12$

Multiplication Examples

See few more examples of multiplication here:

- Multiplication of 3 and 3 = $3 \times 3 = 9$
- Multiplication of 4 by 4 = $4 + 4 + 4 + 4 = 16$
- Multiplication of 5 by 5 = $5 + 5 + 5 + 5 + 5 = 25$
- Multiplication of 10 x 10 = 100
- Multiplication of 8 by 9 = $8 \times 9 = 72$

Multiplication Symbol

The symbol of multiplication is denoted by a cross sign ($\times$) and also sometimes by a dot ($\cdot$).

Multiplication Formula

Multiplier $\times$ Multiplicand = Product

1.9 Multiplication with a series of 9s

3.2.1 Multiplication of a number by same numbers of 9

Traditional method

$$\begin{array}{r} 533 \times 999 \\ 4797 \\ 47970 \end{array}$$

$$\begin{array}{r} 479700 \\ 532467 \\ \hline \end{array}$$

Vedic method

$$533 \times 999$$

This solution can be obtained as

$$\begin{aligned} & \underline{533 \times (1000 - 1)} \\ &= 533000 - 533 \\ &= 532467 \end{aligned}$$

The answer consist of two 3-parts numbers viz. 532 and 467.

The first part 532 is 1 less than the given number, $533 - 1$.

The second part 467 is equal to $(1000 - 533)$ or $(999 - 532)$. It is simply the '9's complement of the first 3 digit of the result, 9's complement of 532 where the required digit can as

$$4=9-5$$

$$6=9-3$$

$$7=9-2$$

3.2.2 Multiplication of a number by greater number of '9's be obtained

Let us now see how to carry out multiplication of an n- digit numbers by a number with greater number of '9's

E.g. 235 by 9999

Normal method

$$\begin{array}{r} 235 \times 9999 \\ 2115 \\ 21150 \\ 211500 \\ + 2115000 \\ \hline 2349765 \end{array}$$

Vedic Method

Since the number of digit in 235 is three while there are four digit in 9999, we pad 235 with one zero to get 0235 and carry out the multiplication as before.

$$0235 \times 9999 = 0234 / (9999 - 0234) = 0234 / 9765$$

And the final result 2349765

Multiplication of number place a very important role in most computation. Vedic maths offers 2 main approaches to multiplying 2 numbers. These are the

- Nikhilam method and
- Urdhva Triyak method

3.3 Nikhilam method

Now by considering multiplication of numbers which are close to a base of 100 , 1000, 10000 etc. Later on we will see the multiplication of numbers close to best like 50 , 500 , 5000 etc and finally any convenient base

For a Base 100, the number which are being multiplied may be

- Less than the base (96 98 95)
- More than the base (104 106 103).
- Mixed (98 104)

3.3.1. Case 1:- integers less than the base (100)

Traditional method –

$$\begin{array}{r}
 93 \\
 \times 98 \\
 \hline
 744 \quad (\text{first multiplied 8 ones by 9 3 Times}) \\
 8370 \quad (\text{Then multiplied 9 tens or 90 by 9 3 Times}) \\
 \hline
 9114. \quad (\text{Added all the two products})
 \end{array}$$

Vedic Method –

Write the two numbers one below the other and write the difference of the base 100 from each of the numbers on the right side as shown

$$\begin{array}{rcl}
 93 & -7 & \dots\dots (93 - 100) \\
 98 & -2 & \dots\dots (98 - 100) \\
 \hline
 91 & / & 14
 \end{array}$$

Take the algebraic sum of digits across any cross wise – pair

e.g. $93 + (-2)$ or $98 + (-7)$.

Both give the same result viz. 91 which is the first part of the answer

This is interpreted as 91 hundreds or 9100 , as the base is 100.

Now just multiply the two difference $(-2) \times (-7)$ to get 14 which is the second part of the answer.

The final answer is then 9114 which can also be interpreted as $9100 + 14$.

Important point.

Since the base is 100 we should have two digits (equal to number of zeros in the base) in the second part of the answer.

- If the number of digits is one, the number is padded with one zero on the left.

E.g. 2×3 will be written as 06.

$$\begin{array}{rcl}
 \text{E.g.} & 98 & -2 \\
 & 97 & -3 \\
 \hline
 & 95 & / 06 \quad (\text{pad 6 with zero to get '06'})
 \end{array}$$

- If the number of digit is more than 2 then the left most digit (in the hundreds position) is carried to the left

E.g.
$$\begin{array}{r} 88 \\ - 12 \\ \hline \end{array}$$

$$\begin{array}{r} 84 \\ - 16 \\ \hline \end{array}$$

$$\begin{array}{r} 72 \\ / 192 \\ \hline \end{array}$$

$$= 73 / 92 \text{ (carry 1 to the left and added to 72 to get 73)}$$

- The method is equally effective even if one number is closed to the base and the other is not.

E.g.
$$\begin{array}{r} 94 \\ - 6 \\ \hline \end{array}$$

$$\begin{array}{r} 35 \\ - 65 \\ \hline \end{array}$$

$$\begin{array}{r} 29 \\ / 390 \\ \hline \end{array}$$

$$= 32 / 90 \text{ (carry 3 to the left and add to 29 to get 32)}$$

3.3.2. Case 2 :- integers above the base (100)

Traditional method –

$$\begin{array}{r} 103 \\ \times 105 \\ \hline \end{array}$$

$$\begin{array}{r} 515 \\ \hline \end{array} \text{ (first multiplied 5 ones by 103)}$$

$$\begin{array}{r} 000 \\ \hline \end{array} \text{ (then multiply 0 tens by 103)}$$

$$\begin{array}{r} + 10300 \\ \hline \end{array} \text{ (now multiply 1 hundreds or 100 by 103)}$$

$$\begin{array}{r} 10815 \\ \hline \end{array} \text{ (added all the three products)}$$

Vedic method –

consider the multiplication of 103×105 that technique remains exactly the same and can be written as follow:

$$\begin{array}{r} 103 \quad + 3 \\ 105 \quad + 5 \\ \hline 108 \quad / 15 \\ \hline \end{array}$$

Notice that both the differences are positive, i.e. $+3$ ($103-100$) and $+5$ ($105-100$).

The addition in the cross wise directions gives 108 ($103+5$ or $105+3$). The product of the difference is 15 and show the final result is 10815.

Once again we have to ensure that we have exactly two digit in the second part of the answer which is achieved by either padding with zero or by carry to the left.

E.g.
$$\begin{array}{r} 113 \times 115 \\ \hline \end{array}$$

$$\begin{array}{r} 113 \quad + 13 \\ \hline \end{array}$$

$$\begin{array}{r} 115 \quad + 15 \\ \hline \end{array}$$

$$\begin{array}{r} 128 \\ / 195 \\ \hline \end{array}$$

$$= 12995 \text{ (carry 1 to the left side)}$$

3.3.3. Case 3 -: integers below and above the base (100)

Traditional method –

$$\begin{array}{r}
 104 \\
 \times 97 \\
 \hline
 728 \quad (\text{first multiply 7 ones by 104}) \\
 9360 \quad (\text{then multiply 9 tens or 90 by 104}) \\
 \hline
 10088 \quad (\text{added all the multiplies})
 \end{array}$$

Vedic Method – hair 97 is below 100 while 104 is above 100 .

Using the same technique we get . 104×97

$$\begin{array}{r}
 104 \quad +4 \\
 97 \quad -3 \\
 \hline
 101 / (-12)
 \end{array}$$

Hare the second part of the answer is -12 . We now carry 1 from the left which is equivalent to 100 (since the base is 100) and the final answer is obtained as follow

$$\begin{aligned}
 101 / (-12) &= 100 / (100 - 12) \\
 &= 100 / 88 = 10088
 \end{aligned}$$

This can also be interpreted as $10100 - 12 = 10088$

3.3.4. Case 4 -: other bases — 50, 250, 500

Let us now consider the multiplication of numbers which may be closed to other bases like 50, 250, 500 etc which are the multiplies of 50. Later we will see how the method can be extended to bases like 40 which are not multiple of 50. The reader will then be able to extend the method to any base of his choice

1. Case – Secondary base of 50

Example -: consider the multiplication of $42 * 46$

Here we can take the secondary base as 50 the corresponding primary waves can be considered as 10 or 100 the scaling factors between the primary and secondary base would be as follow

Factor = Secondary base / Primary base

$$5 = 50 / 10 \quad (\text{if Primary base} = 10)$$

$$1/2 = 50 / 100 \quad (\text{if Primary base} = 100)$$

We can use either of this scaling operations and compute the required answer let us see each case in detail.

Case 1 – Primary base 10 and secondary waves 50 for

$$42 \times 46$$

- Secondary base is 50
- Scaling operations : factor = $5 = 50/10$
- One digit to be written in the right hand part of the answer because primary base has one zero

The initial part of the method remainder same and it has follow

Consider : 42×46 (subtract 50 from each number)

$$\begin{array}{r} 42 \quad - 8 \\ \underline{46 \quad - 4} \\ 38 \quad / \quad 32 \end{array}$$

Now we have to scale up the left part of the intermediate result by multiplying by 5

Since $38 \times 5 = 190$ the answer become $190 / 32$.

Since the primary base 10 contains 10 contains one zero, we retain one digit in the right part of the answer and carry 3 to the left

So the final answer becomes 1932

2. Case – Primary base 100 and secondary Base 50

Consider: 42×46 (subtract 50 from each number)

$$\begin{array}{r} 42 \quad - 8 \\ \underline{46 \quad - 4} \\ 38 \quad / \quad 32 \end{array}$$

Now we have to scale down the left part of this intermediate result by multiply it by $1 / 2$ Since $38 / 2 = 19$, the answer become $19 / 32 = 1932$

Since the primary bases 100 which contain two zeroes , we will retain 2 digit in the right part of the answer . Show the final answer becomes 1932

3. Case – Secondary base of 250

Example – consider the multiplication of 266×235

Traditional method:

$$\begin{array}{r} \underline{266 \times 235} \\ 1330. \quad (\text{ first multiply 5 ones by 266 }) \\ 7980. \quad (\text{ Then multiplied 3 tens or 30 by 266 }) \\ \underline{53200} \quad (\text{ now multiply 2 hundred by 266 }) \\ \underline{62510.} \quad (\text{ sum of all multiplication }) \end{array}$$

Vedic Method

Case 1- Primary base 1000 and secondary base 250

- Secondary base is 250
- Scaling operation : Factor = $1 / 4 = 250 / 1000$
- Three digit to be retained in the right hand part of the answer

Consider: 235×266 (subtract 250 form each number)

$$\begin{array}{r} 235 \quad - 15 \\ 266 \quad + 16 \\ \hline 251 \quad / \quad (-240) \end{array}$$

We will scale down this intermediate result by dividing 251 by 4

Since $251 / 4 = 62 \frac{3}{4}$ = the answer become $62 \frac{3}{4} / (-240)$

Since the primary bases 1000 we will carry $3/4^{\text{th}}$ from the left which is equal to carry of 750 (Primary base $1000 \times \frac{3}{4}$) and subtract 240 from 750 giving 510.

So the final answer becomes $62 / 510 = 62510$

3.4 Urdhva Tiryak

We will not considered the other method of multiplication viz da Urdhva Tiryak or cross multiplication technique. It consists of vertical and cross multiplication between the various digit and give the final result in the single line.

We will consider the multiplication of the following :-

- Two 2-digit numbers
- Two 3-digit numbers

3.4.1. Case 1: 2-digit multiplication

Consider the following multiplication as done by the

Traditional methods

$$\begin{array}{r} 38 \\ \times 52 \\ \hline 76 \\ 1900 \\ \hline 1976 \end{array}$$

Vedic method

The vedic maths method consist off computing 3 digits as shown

$$\begin{array}{r} 38 \\ \times 52 \\ \hline 15 / 46 / 16 \end{array}$$

Steps

- Multiply the right most digits 8 and 2 to get 16

- Carry out a cross multiplication between 3 and 2 , and 8 and 5 to get 6 and 40 respectively and on the adding them we get 46
- Multiply the left most digit 3 and 5 to get 15
- We have to return 1 digit at each of the three locations and carry the surplus to the left
15 / 46 / 16

we start from the right returns 6 and carry 1 to the left this gives 47 in the middle location. Now be written 7 and carry 4 to the left at 4 to 15 to get 19 . This gives 19/7/6 i.e. 1976 which is the required answer.

3.4.2. Case 2: 3- digits multiplication

Let us love consider multiplication of 2 3 digit numbers.

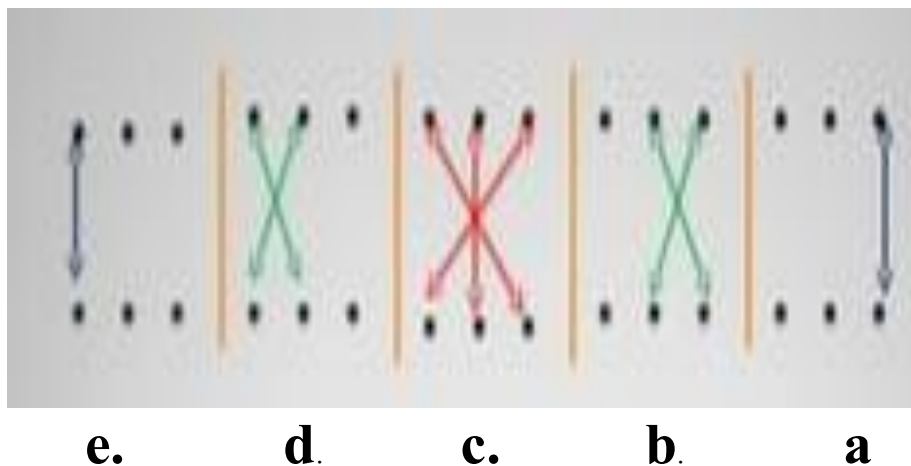
Consider the following example

Traditional method

$$\begin{array}{r}
 326 \\
 \times 258 \\
 \hline
 2608 \\
 16100 \\
 \hline
 65200 \\
 \hline
 84108
 \end{array}$$

Vedic method –

the vedic methods consist of computing 5 digits A.B.C.D and E as shown in the figur



Digit (a) : multiply the right most digit sex and to get 48 be right eight and show 4 as the carry on the left side.

Digit (b) : carry out a 2-digit cross multiplication between 2 and 8. (16) , and 6 and 5 (30).

- Add the product 16 and 30 to get 46
- Add the carry digit 4 and get 50
- Write down 0 and show the carry as 5

Digit (c) : Carry out a 3 digit cross multiplication between 3 and 8 (24) and 6 and 2 (12) and 2 and 5 (10)

- Add the three products 24 , 12 and 10 to get 46.
- Add the carry digit 5 and get 51
- Write down one and show the carry as 5

Digit (d) : Carry out to digit cross multiplication between 3 and 5 (15) and 2 and 2 (4).

- Add 15 and 4 to get 19.
- Add the carry digit 5 to get 24.
- Write down 4 and show 2 as the carry.

Digit e : Multiply the left most digits 3 and 2 to get 6. Add the carry digit 2 to it to get 8

Finally the multiplication looks as follow

$$\begin{array}{r}
 \begin{array}{rcccc}
 & 3 & 2 & 6 & \\
 \times & 2 & 5 & 8 & \\
 \hline
 8 & : & 4 & : & 1 & : & 0 & : & 8 \\
 & 2 & 5 & 5 & 4 &
 \end{array}
 \end{array}$$



Chapter IV

Inclusion in the Curriculum

- 4.1 Class 5th Highest Common Factor**
- 4.2 Class 5th Least Common Multiple**
- 4.3 Multiplication**
- 4.4 Simple Equations**
- 4.5 Total Surface Area of Cuboid**



Chapter 4

Inclusion in the Curriculum

Vedic math suggestions for inclusion are shown on a colored background

4.1 Class 5 Highest common factor

Look at the numbers given below and write the answer –

1, 3, 10, 18, 19.

- Which of the numbers are even ?
- Which of the numbers are odd ?
- Which of the numbers are prime ?
- Are 18 and 19 co-prime numbers ?
- Which of the numbers are composite ?
- Which of the numbers are neither composite nor the prime

H.C.F by prime factorization method

Let's see – prime factorization of 15 and 18

$$15 = 3 \times 5. \quad (\text{Here 15 and 18 are factorized into prime numbers})$$

$$18 = 3 \times 3 \times 2$$

The method in which any number is divided into its prime factors is called the prime factorization method

Finding H.C.F. of 8, 12 and 16 by factorization method

$$8 = 2 \times 2 \times 2$$

$$12 = 2 \times 2 \times 3$$

$$16 = 2 \times 2 \times 2 \times 2$$

In the prime factors of 8, 12 and 16 the numbers 2 in the yellow band and number 2 in the green band are common factors of all the 3 numbers

The product of these common factors will be the H.C.F. thus, $2 \times 2 = 4$

Therefore H.C.F. of the given numbers 8, 12 and 16 is 4

By Vedic method

Addition subtraction method – Adding and subtracting numbers makes the greatest common factor very simple.

Example : find the HCF of 8 12 and 16

Solution : sum of the number of first and second = $8 + 12 = 20$

Subtract 3rd numbers by sum of 1st and 2nd = $20 - 16 = 4$

H.C.F of the number 8, 12 and 16 is 4

Do it yourself

Find the HCF of factorization method

- 5 and 15
- 12, 21 and 24

4.2 Class 5 Least Common Multiple.

Prime Factorization method of Least Common Multiple.

$$15 = 3 \times 5 \quad (\text{Here, 15 and 20 are factorised in prime factors})$$

$$20 = 2 \times 2 \times 5$$

We see that the number '5' written in green band is a common factor 3,2 and 2 are not the common factors of the numbers.

To find the LCM be multiplied the common factors with all the other factors which are not common. The product found is the LCM

$$\text{Thus L.C.M.} = 5 \times 2 \times 2 \times 3 = 60$$

The least common factor is the smallest number in which the complete division of the given numbers can be given. The method of extracting .L.C.M is very easy and simple.

4.2.1 Method to find LCM of two numbers

1. Two numbers as fractions, write their simplest form in front of them.
2. Cross multiply these two products will be equal
3. This product is the least common factor

4. If the number has increased and there is difficulty in finding their ratio, then we can also find it by addition and subtraction.
5. Division rules can also be used to find simple ratios.

LCM of two numbers by Vedic maths

LCM of 15 and 20

$$\underline{15} = \underline{3 \times 5} = \underline{3}$$

$$20 = 4 \times 5 = 4$$

$$\underline{\text{L.C.M.}} = 15 \times 4 = 60$$

$$\text{Or} = 20 \times 3 = 60$$

Let's see this too –

L.C.M of 8, 12 and 30

$$8 = \boxed{2} \times \boxed{2} \times 2$$

$$12 = \boxed{2} \times \boxed{2} \times \boxed{3}$$

$$30 = \boxed{2} \times 5 \times \boxed{3}$$

For Least Common Multiple :

- First of all, the multiply the factors which are common in the factors of list two of the given numbers

e.g. 2 written in the Blue band 2 written in the green band and 3 written in the red band are common.

$$2 \times 2 \times 3$$

- Then we also multiply the factors which are not common with the common factors Thus, the product obtained by this way is the L.C.M.

$$2 \times 2 \times 3 \times 2 \times 5 = 120$$

Thus , 120 is the L.C.M of 8, 12 and 30.

L.C.M of three numbers by Vedic math

LCM of 8 , 12 and 30

First step – find out the L.C.M by writing the first two numbers in the form of fraction –

$$8 / 12 = 2 / 3 \quad (\text{be find out the simplest form of the fractions})$$

$$8 \times 3 = 12 \times 2 = 24 \quad (\text{cross multiply})$$

24 is the L.C.M of 8 and 12.

Second step – Now write the L.C.M. 24 obtained in the first step and the third number 30 in the form of fraction

$$24 / 30 = 4 / 5 \quad (\text{be find out the simplest form of the fractions})$$

$$24 \times 5 = 30 \times 4 = 120 \quad (\text{cross multiply})$$

Therefore 120. Is the LCM of 8, 12 and 13

4.3 Multiplication

Multiplication is the process of calculating the product of two or more numbers. The multiplication of numbers say, 'a' and 'b', is stated as 'a' multiplied by 'b'.

In Maths, the basic explanation of multiplication is adding a number, with respect to another number, repeatedly. We know that the repeated addition of a certain number is multiplication.

Such as: $2+2+2+2+2=12$

Or 6 times 2 = 12

Example 1 : Find the Multiplication of 60 and 12

Traditional Method

Solution : T O

$$\begin{array}{r} 60 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 120 \\ + 600 \\ \hline \end{array}$$

$$\begin{array}{r} 120 \\ + 600 \\ \hline \end{array}$$

$$\begin{array}{r} 120 \\ + 600 \\ \hline \end{array}$$

$$\begin{array}{r} 120 \\ + 600 \\ \hline \end{array}$$

2 ones multiplied by 60

1 tens or 10 multiplied by 60

then both the product are added

Vedic Method

$$60 \times 12$$

This solution can be obtained as

$$= 60 (10 + 2)$$

$$= 600 + 120$$

$$= 720$$

The answer consist of two 2-parts numbers viz. $600 + 120 = 720$

4.4 Class 7 Simple equation

Unit 7

Simple equation (linear equations)

Role

Formulating a linear equation in one variable in the previous class, writing some mathematical problems and statements related to daily life in the form of an equation and finding their solutions,

Now here we will know about such an equation method which has variables on both sides.

Solving equations of the type $ax+b=cx+d$ (where $a \neq c$)

Example 1 : Solve the equation $5x - 4 = 4x$

Solution : $5x - 4 = 4x$

Or $5x - 4x = 4$ (change to side of term -4 and 4x)

$$X = 4$$

Check answer :

$$\begin{aligned} \text{Taking L.H.S.} &= 5x - 4 \\ &= 5 \times 4 - 4 \\ &= 20 - 4 \\ &= 16 \end{aligned}$$

$$\begin{aligned} \text{Taking R.H.S.} &= 4 \times 4 \\ &= 16 \end{aligned}$$

Therefore Answer is right

Solving simple equation by vedic maths

$$ax + b = cx + d \text{ then } x = (d - b) / (a - c)$$

$$(a = 5, \quad b = -4, \quad c = 4, \quad d = 0)$$

$$X = [0 - (-4)] / (5 - 4)$$

$$X = 4 / 1$$

$$X = 4$$

Example 2 : Solve the equation $3x - 5 = x + 3$

Solution : $3x - 5 = x + 3$

$$3x - x = 3 + 5 \quad (\text{change to side of term } x \text{ \& } 5)$$

$$2x = 8$$

$$X = 8/2$$

$$X = 4$$

Check the answer:

Taking L.H.S. $= 3x - 5$

$$= 3 \times 4 - 5$$

$$= 12 - 5 = 7$$

Taking R.H.S. $= x + 3$

$$= 4 + 3$$

$$= 7 \quad \text{Therefore Answer is right}$$

Solving simple equation by vedics Maths

$$ax + b = cx + d \text{ then } x = (d - b) / (a - c)$$

$$(a = 3, \quad b = -5, \quad c = 1, \quad d = 3)$$

$$X = [3 - (-5)] / [3 - 1]$$

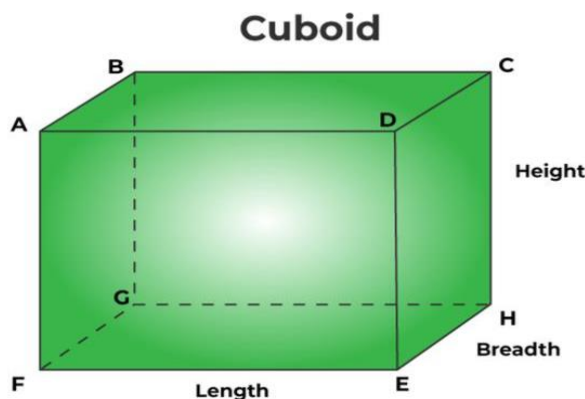
$$X = 8 / 2$$

$$X = 4$$

4.5 Class-7 Total Surface Area of Cuboid

Total Surface Area:

We have seen that many items are sold in the market packed in tin sheets, carton boxes or thick paper boxes, many of these packings are in the shape of a cuboid. Tin boxes, almirahs etc. are also in the shape of a cuboid. It becomes necessary for the manufacturer to know how many sheets, cartons or thick paper etc. will be required for the manufacture of these articles. To know this, we need to know its entire page.



See the above figure

In a cuboid, let the length of the cuboid be l in cm, width b in cm and height h in cm, then find the total surface area.

- We know that the total surface area of a cuboid is equal to the sum of the areas of all its six faces.

Therefore, the sum of the area of the upper and lower face –

$$= (l \times b + l \times b) \text{ cm}^2$$

$$= 2lb \text{ cm}^2$$

Therefore, the sum of the areas of the left and right sides –

$$= (b \times h + b \times h) \text{ cm}^2$$

$$= 2bh \text{ cm}^2$$

Therefore, Sum of the areas of the front and back faces –

$$= (h \times l + h \times l) \text{ cm}^2$$

$$= 2hl \text{ cm}^2$$

Total surface area = the sum of all faces of cuboid

$$= (2lb + 2bh + 2hl) \text{ cm}^2$$

$$= 2(lb + bh + hl) \text{ cm}^2$$

Total surface area

$$= 2(\text{length} \times \text{breadth} + \text{breadth} \times \text{height} + \text{height} \times \text{length})$$

$$= 2 (lb + bh + hl)$$

Example 3 : Find the total surface area of a cuboid whose length is 10 cm, width is 8 cm and height is 5 cm.

Solution : given $l = 10$, $b = 8$, and $h = 5$

So, Total surface area of cuboid $= 2 (lb + bh + hl)$

$$= 2 (10 \times 8 + 8 \times 5 + 5 \times 10) \text{ cm}^2$$

$$= 2 (80 + 40 + 50) \text{ cm}^2$$

$$= 2 \times 170 \text{ cm}^2$$

$$= 340 \text{ cm}^2$$

By Vedics method

Example 3 : Find the total surface area of a cuboid whose length is 10 cm, width is 8 cm and height is 5 cm.

Solution I : given $l = 10$, $b = 8$, and $h = 5$

So, Total surface area of cuboid $= 2 (lb + bh + hl)$

$$= 2 (10 \times 8 + 8 \times 5 + 5 \times 10) \text{ cm}^2$$

$$= 2 \times 170 \text{ cm}^2$$

$$= 340 \text{ cm}^2$$

Chapter V



Conclusion and Suggestions

5th Chapter

Conclusion and Suggestions

5.1 Conclusion

As a result of the presented Study the following conclusions have been obtained-

- Vedic Mathematics is Based on 16-point principles. Therefore, there is a need to remember its formula through continuous practice.
- Vedic Mathematics can be applied in higher grade classes also.
- Now a days in schools traditional Mathematics teaching is in the practice of students due to continuous practice.
- Complex Problems can be solved easily through Vedic Mathematics.
- Mental power of students is developed through Vedic Mathematics.
- Students can be freed from Mathematical Problems in less time.
- Use of Vedic Mathematics helps competitive students in time management.
- Solving Mathematical operations through Vedic Mathematics takes less time than traditional Mathematics teaching.

5.2 Suggestions

1 There is a need to do more and more research in the field of Vedic Mathematics so that—

- Other deep secrets of Vedic Mathematics can be unveiled.
 - New possibilities related to experiments in modern Mathematics can be highlighted.
 - To make the computer faster, software can be created based on the formulas of Vedic Mathematics.
- 2 In the traditional education system, Sanskrit should be made compulsory for Mathematics students or Mathematics and Sanskrit streams should be united so that students can have better understanding of the formulas of Vedic Mathematics.
 - 3 Various workshops and training programs on Vedic Mathematics should be organized so that it can prove helpful not only for the students but also for the teachers for qualitative improvement in Mathematics teaching.
 - 4 The use of Vedic Mathematics in teaching will definitely explore new dimensions.
 - 5 Learning Vedic Mathematics through technology will be more helpful for the students.

5.3 Educational Implications

The objective of studying Vedic Mathematics is to generate interest in the subject of Mathematics among the students. The aim is to free students from the fear of current Mathematics teaching. The students have to be freed. Students have to study Mathematics in a simple and entertaining manner. Vedic Mathematics is capable of solving the Mathematical problems of students. At present, the study of Mathematics is beneficial in every field of life, but

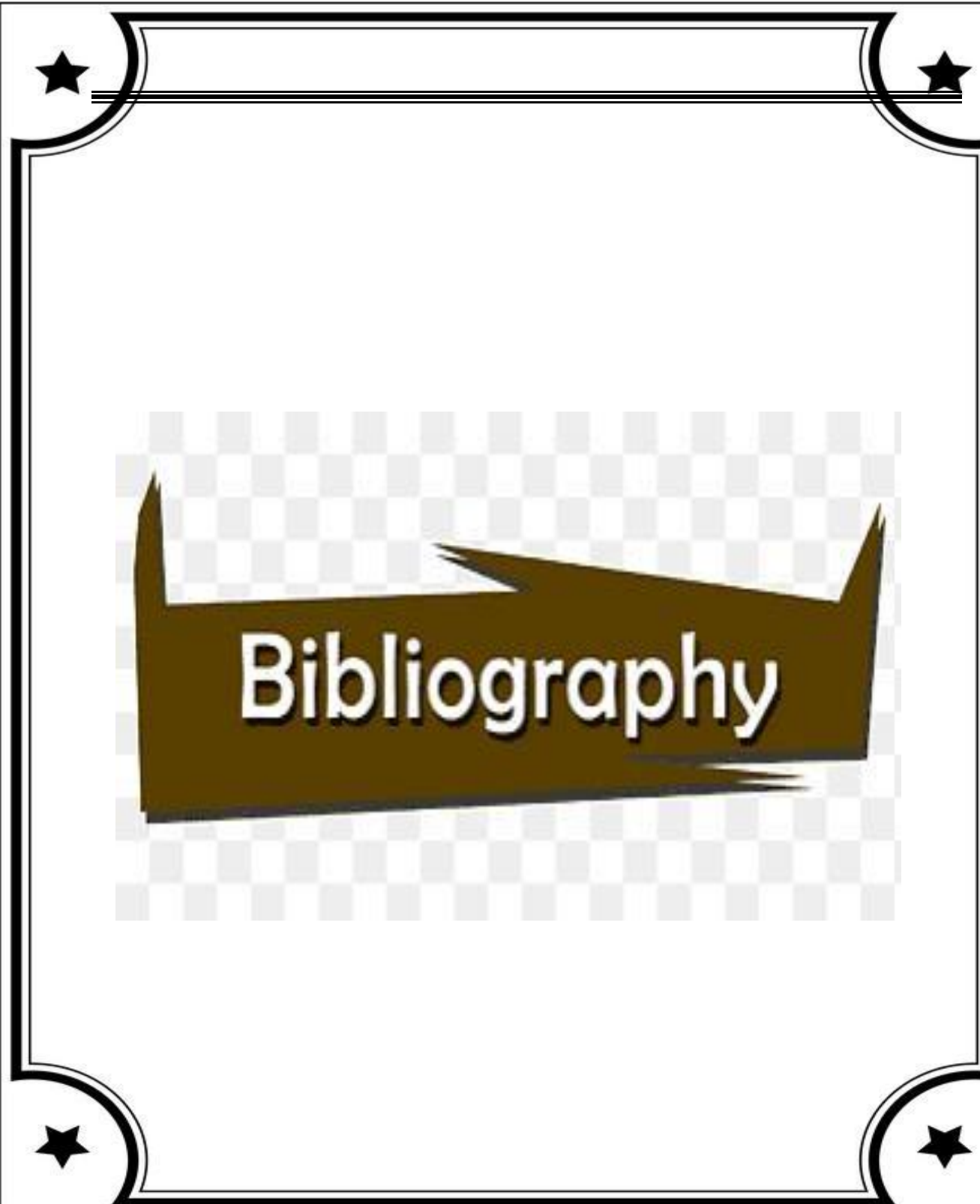
as a result of the difficulties in the educational methods of mathematics, thousands of students are running away from Mathematics education. The highest percentage of students failing at the high school level is in Mathematics. We are trying to remove these errors by studying Vedic Mathematics.

Study of Vedic Mathematics is beneficial for primary, secondary and higher level classes. Mathematical problems can be solved by the student by studying its simple formulas and methods. As a result of its study, the reasoning power and mental strength of the students can be increased. Studying this book is useful for students as well as teachers. Through this, teachers can make qualitative improvement in their teaching. The objective of this research is to improve qualitatively in Mathematics teaching. By which a bright future can be created for the students.

5.4 Suggestions for Future Research

No research is final. The researcher felt that at present this problem can be researched on different dimensions. There are still many possibilities which can be taken in future research—

1. A study of the impact of Vedic Mathematics on competitive students.
2. A study of problems of algebraic mathematical operations through Vedic Mathematics.
3. A comparative study on intelligence quotient of students studying Vedic Mathematics.
4. A study of awareness of Vedic Mathematics among students (primary/ secondary/ higher).
5. A study of awareness of Vedic Mathematics among Mathematics teachers.
6. In the present small research, suggestions have been presented for the inclusion of Vedic mathematics operations in the text books of class 4, 5 and class 7. In the future research, inclusion of Vedic mathematics can be taken in the mathematics curriculum of other classes.
7. In the present study, the work of inclusion of Vedic Mathematics operations in the English medium Mathematics book has been done. In future research, the work of inclusion of Vedic mathematics can be done in the Mathematics textbooks of other mediums.
8. In the present study, suggestions have been presented for the inclusion of LCM, HCF, multiplication and surface area of Vedic Mathematics. Other operations of Vedic Mathematics can be taken up in future research.



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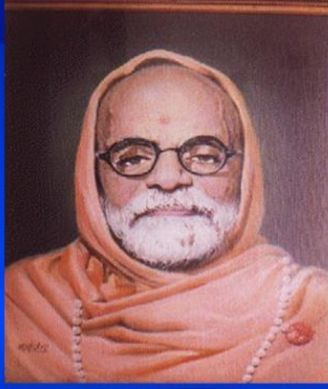
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Appendix–A

Vedic Mathematics' Pioneer: Bharati Krsna Tirthaji, Maharaja

Jagadguru Swami Sri Bharati Krsna Tirthaji Maharaja



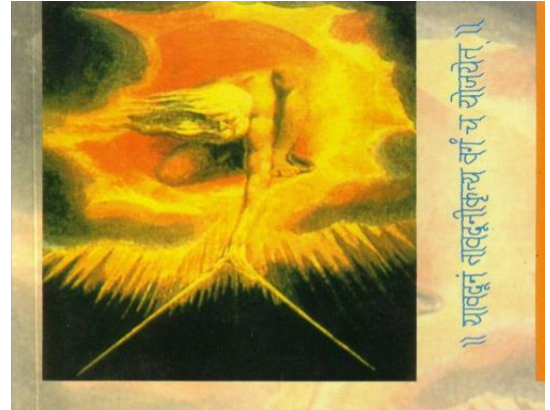
- Born in 1884 to an educated and pious family
- Received top marks in school
- Sat for the M.A. exam of the American College of Sciences (Rochester NY) in Sanskrit, Philosophy, English, Mathematics, History and Science.

Image Source:

who/Tirthaji portrait.gif

INTRODUCTION

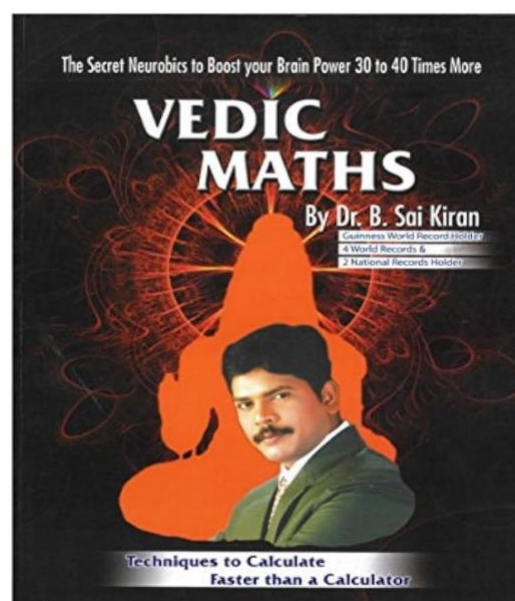
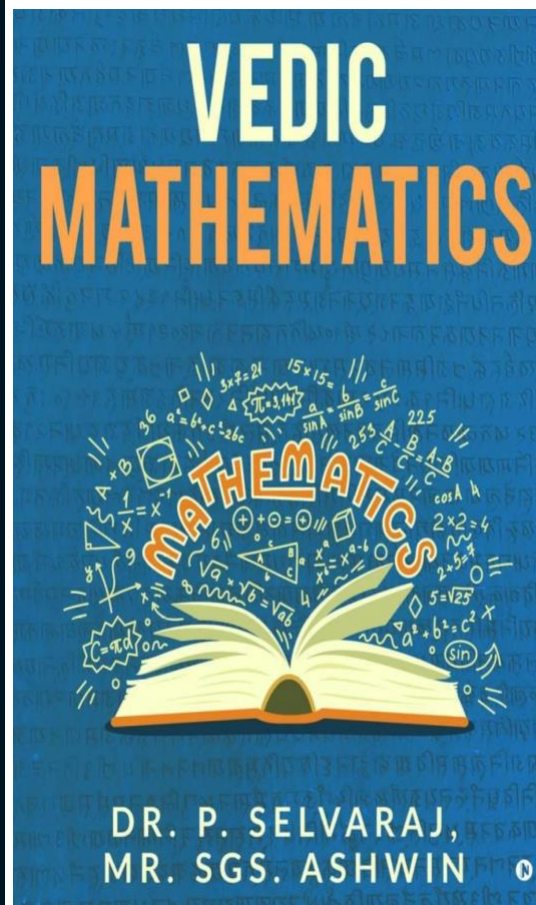
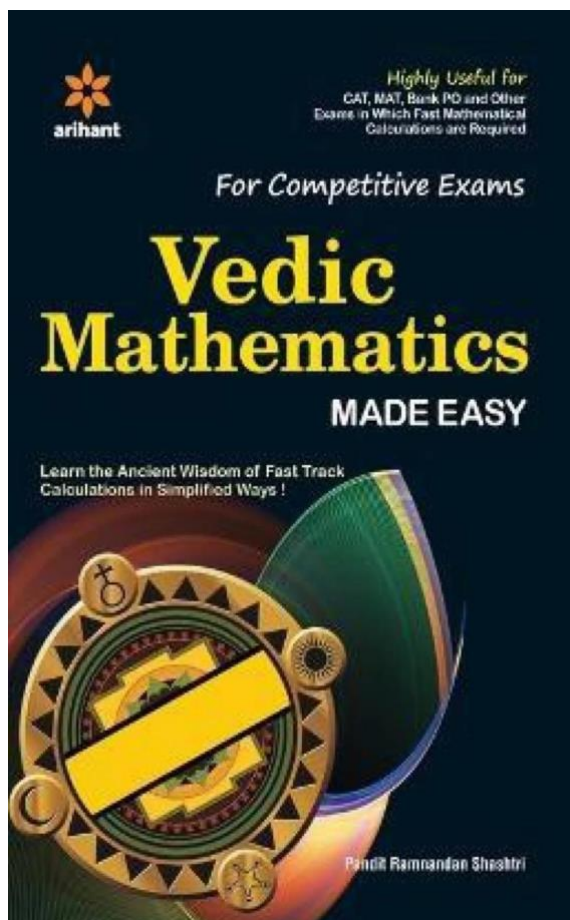
- Vedic Mathematics is an ancient system of mathematics that was rediscovered by **Bharati Krishna Tirthaji** between 1911 and 1918
- The system was rediscovered from ancient Sanskrit text early last century.



Vedic Mathematics
Bharati Krsna Tirthaji
(Soft Cover)

Appendix-B

Books on Vedic Mathematics



Appendix-C

News Related to Vedic Mathematics

वैदिक गणित ने सिखाया गणित का असली प्रयोग

कानपुर | कार्यालय तंवादाता

कार्यशाला

वैदिक गणित ने असली में सबको गणित सिखाया है। गणित के सवालों से दूर भागने वाले छात्रों को अगर वैदिक गणित सिखाई जाए तो वे मिनटों में उन सवालों को हल कर लेंगे। वैदिक गणित कठिन सवालों को आसान बनाती है। यह बात वैदिक मैथ्स फोरम ऑफ इंडिया के अध्यक्ष गौरव टेकरवाल ने कही। उन्होंने वैदिक गणित के फायदे के बारे में जानकारी दी। कार्यक्रम से पहले कॉलेज के एनसीसी कैडेट्स ने कुलपति को सलामी भी दी।

सिविल लाइंस स्थित डीएवी कॉलेज में गणित विभाग की ओर से रिलेक्स ऑफ वैदिक मैथमेटिक्स इन स्कूल्स एंड कॉलेजों विषय पर दो दिवसीय सेमिनार का आयोजन हुआ। सेमिनार का शुभारंभ मुख्य अतिथि सीएसजेएमयू की कुलपति प्रो. नीलिमा गुप्ता, दयानंद शिक्षण संस्थान की सदस्य कुमकुम स्वरूप, संयुक्त सचिव गौरवेंद्र स्वरूप, प्राचार्य डॉ. अमित श्रीवास्तव ने दीप प्रज्ज्वलित कर किया।

डॉ. एन सिंह, डॉ. पुष्पेंद्र त्रिपाठी, डॉ. अभिषेक कुमार, डॉ. अनिला त्रिपाठी, डॉ. हेमंत कुमार, डॉ. संतराम वर्मा रहे।

13 अक्टूबर 2018

द्विघातीय समीकरण का वैदिक गणित से हल निकलने की विधि बताई

कानपुर | डीएवी कॉलेज में आयोजित वैदिक गणित सेमिनार में डॉ. नीलिमा गुप्ता ने द्विघातीय समीकरण का वैदिक गणित से हल निकलने की विधि बताई।

डॉ. एन सिंह, डॉ. पुष्पेंद्र त्रिपाठी, डॉ. अभिषेक कुमार, डॉ. अनिला त्रिपाठी, डॉ. हेमंत कुमार, डॉ. संतराम वर्मा रहे।

Where the logic ends spiritualism begins Because even the logic has a limit

Puri seer imparted Vedic Maths formula to ISRO for Chandrayaan-2

AMBICA PRASAD KANUNGO BHUBANESWAR, AUG. 3

Vedic Mathematics formula has been imparted by Shankaracharya Nischalananda Saraswati to Indian Space Research Organisation (ISRO) scientists and scholars which is considered a significant contribution to the successful launching of the Chandrayaan-2 mission.

Jagadguru Sankaracharya of Govardhan Peetha was invited by ISRO to its Ahmedabad centre on November 25, 2018 for remedies through Vedic Mathematics and easy calculations of space distance.

Swami Nischalananda Saraswati is not just a spiritual guru but also a veteran mathematician. He is following the footsteps of his predecessor the great Shankaracharya Bharat Krishna Tirtha who was famous all over the world for his Vedic Mathematics, astronomy, and missile technology.

Puri Shankaracharya says, "Rocket science has developed since mythological periods in different forms and names. There are many narrations in 'Mahabharata' and 'Puranas' about vimanas (flying vehicles) used by many gods and goddesses.

"The Mahabharata war had a death toll of around 16 billion people in 18 days. The death toll destruction caused during the nuclear attack at Nagasaki in Japan. So, we can say even weapons used in the present era were similar to that of the ancient period."

ISRO chairman Dr. Kiran Kumar along with 1000 space scientists and scholars were present during Jagadguru Shankaracharya's invitation visit to its Ahmedabad centre.

Puri Shankaracharya had delivered the formula of Vedic mathematical calculations to be used for the launching of Chandrayaan-2. He had advised the space scientists to implement the Vedic theories and calculations mentioned in the Vedic Sutra Palm leaf to achieve success in the Moon mission.

Swami Nischalananda Saraswati has written 11 well-known books for enrichment of Vedic Mathematics.

PRO of Govardhan Peetha and Bramhachari Nishesh Manoj Rath said, "Many experts from all over the world seek his advice and suggestions of mathematical research and they are inspired by his works."

Vedic Math Copyright Row

CHENNAI

Indians upset over Vedic maths patent

दैनिक भास्कर

वैदिक गणित पर अमेरिकी हक?

एक अमेरिकी कम्पनी अमेरिकी हक का दावा है कि वैदिक गणित को एक अमेरिकी कम्पनी के हक में दे दिया गया है।

अमेरिकी कम्पनी ने वैदिक गणित पर अमेरिकी हक का दावा किया है।

अमेरिकी कम्पनी ने वैदिक गणित पर अमेरिकी हक का दावा किया है।

Appendix– D

Researcher's Profile

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FATHER'S NAME : LATE. Mr. RAMJEET

POSITION : STUDENT TEACHER

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E-mail Address: : surendramath824@gmail.com

**Present Address: : KACHHIYA PURWA (DABHANI), POST-PARA,
BLOCK – BISANDA, ATARRA, BANDA, U.P 210203**



ACADAMICS:

Certificate/Degree.	Institution.	Marks.	Grade/Class
High School.	P.N.I.Collage Pahari	404/ 600.	1 st Class
Intermediate.	S.I.C Atarra Banda	364/500.	1 st Class
Graduation.	S.S.L.M Baberu Banda.	793/1350.	2 nd Class
Post Graduation.	M.G.G.U Satana	673/ 800.	1 st Class
B.Ed.	M.C.B.U Chhatarpur	1390/1800.	1 st Class
M.Ed.	Bundelkhand University		

Published Book—

क्रमांक	शीर्षक	वर्ष	पृष्ठ संख्या	ISBN	वेबसाइट
1.	Study of Consumer Awareness Among Students of Banda District	2022	77	978-93- 5680-244- 5	https://archive.org/details/sk_20221006/mode/2up

Date: 08/11/2023

Surendra Kumar

Place: Atarra



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